UNIVERSITY "PROF. DR. ASEN ZLATAROV" – BURGAS

MEDICAL FACULTY

DEPARTMENT OF ANATOMY, HISTOLOGY, EMBRYOLOGY, PATHOLOGY, FORENSIC MEDICINE AND ETHICS

Approved by:

DEAN

/Assoc. Prof. Rumyana Yankova, PhD/ /

S Y L L A B U S

Discipline:	**CYTOLOGY, GENERAL HISTOLOGY AND EMBRYOLOGY**
Specialty:	**MEDICINE**
Professional field:	**7.1. Medicine**
Educational and qualification degree:	**MASTER**
Form of training:	**REGULAR**

Burgas, 2023

EXTRACTS FROM THE CURRICULUM

1. GENERAL PARAMETERS OF THE DISCIPLINE			
Total (academic hours):	180	**ECTS:**	6
Auditorium classes	**Non-auditorium classes**	**Auditorium ECTS**	**Non-auditorium ECTS**
90	**90**	**3**	**3**
Type of Discipline:	**Academic hours per week: /lectures + practices/**	*Course:*	*Semester:*
Mandatory	3 + 3	I	I

2. STUDY FORMS					
Auditorium classes:	**Academic hours**	**ECTS**	**Non-auditorium classes:**	**Academic hours**	**ECTS**
Lectures	45	1.5	**Consultation**	30	1
Practices	45	1.5	**Individual work**	60	2

3.EVALUATION AND CONTROL	
Forms of evaluation and control	**Relative share in the total score**
Sessional evaluation: exam	**0.4**
Semester (ongoing) assessment:	**0.6**
Forms of semester control:	
- Colloquium	**0.7**
- Evaluation of the protocol notebook	**0.3**

ANNOTATION

of the discipline "Cytology, general histology and embryology"

The course of cytology, general histology and embryology aims to provide in medical students basic knowledge about the structural organization and functions of cells and tissues as well as formation and development of the human embryo.

Structure of the learning content:

Cytology – studying the structure of the eukaryotic cells:

- ✓ Plasma membrane (plasmalemma) - structural, ultrastructural and chemical organization, cell contacts, specialization the cell surface - cilia, flagella, microvilli, basolateral folds, transport of the substances through the cell membrane;
- ✓ Cell organelles - light-microscopic, ultra-microscopic characteristics, chemical composition, functions;
- ✓ Specialized cell organelles - light-microscopic, ultramicroscopic characteristics, chemical composition, functions;
- ✓ Nucleus in interfase- number, shape, elements of nucleus - ultramicroscopic characteristic;
- ✓ Cell division. Mitosis - phases;
- ✓ Cytophysiology.

General Histology – studying the main tissues of the human body – histogenesis, lightmicroscopical, electronmicroscopical, histochemical and functional characteristics: epithelial tissue, connective tissue, blood tissue, muscle tissue, nervous tissue, reproductive tissue.

Embryology – studying the embryonal development and the initial stages of the fetal period, twins, anomalies in the human embryonal development.

Practical skills and knowledge of the discipline

In practical terms, students should:

- ✓ learn to work with a microscope by acquiring habits to protect the microscope and preparations from damage
- ✓ be able to recognize the different structures of the cell, as well as the types of tissues and their cells and intercellular substance
- ✓ be able to recognize the initial stages of prenatal development
- ✓ be able to recognize the cellular structures of electron-microscopic photographs
- ✓ acquire basic knowledge on the preparation of histological preparations

Teaching Tools:

Light-microscopic preparations, electronograms, atlases, collection of tests, multimedia presentations, discussions, demonstration of histological methods and tools, solving practical - clinically oriented.

Assessment of acquired knowledge.

Grading scores during the semester.

- ✓ Three midterm tests during the semester – cover each of the three main divisions: Cytology, General Histology and Embryology.

Final Exam:

- ✓ Practical exam
- ✓ Theoretical exam with a written part stored in the archive of the department and oral part.

Expected results

Students should have the following knowledge upon completion of the studies:

- ✓ general morphology of the eukaryotic cell: cell membrane - chemical composition, structural models, specialized structures of the cell membrane - intercellular contacts, microvilli, cilia. forms of transport across the cell membrane.
- ✓ cell organelles - obligatory, specialized and cell inclusions.
- ✓ cell nucleus in interphase and mitosis. nucleus in interphase – morphology, chromatin, nuclear envelope and pores, nucleolus and nuclear matrix. Cell division - mitosis; phases of mitosis.
- ✓ the characteristic microscopic and ultramicroscopic features of tissues - epithelial, connective, blood, muscle, nervous, sexual.
- ✓ general embryology -human development from a zygote to a full-fledged multicellular organism - embryonic development, as well as the early stages of the fetal period, formation and construction of the placenta.
- ✓ the main developmental disorders - embryopathies and fetopathies.

LECTURE TOPICS

Winter semester		
№	**Topic**	**Hours**
1	Life – a property of matter. Characteristics of living matter. The cell – a state of matter organization. Definition, general data. Chemical composition and hierarchy in cellular organization. Basic cytological terms.	1
2	External morphology of the cell. Internal morphology of the cell - cell structure classification. Biological membranes – definition, chemical composition, ultrastructure, relationships and functions. Plasmalemma and glycocalyx. Cytoplasmic matrix (intracellular matrix) (cytosol). Endoplasmic reticulum (ER). Ribosomes; polysomes.	2
3	Golgi apparatus. Lysosomes. Peroxisomes. Mitochondria.	2
4	The cytoskeleton – microfilaments, intermediate filaments and microtubules. Centrioles. Cytocenter. Derivatives of the centrioles – cilia and flagella. Specific cellular organelles. Cell inclusions. Specialized structures with plasmalemma participation on the apical, lateral, and basal surface of the cell.	3

5	Cell nucleus in interphase.	2
6	Cell physiology – cell metabolism, cell signaling, cell cycle. Mitosis. Cell reactivity, motility, differentiation, degeneration and death.	2
7	General Histology. Tissues - definition, classification, origin, general properties. Epithelial tissue – definition, characteristics, functions and classification. Covering epithelia (I).	2
8	Covering epithelia (II). Glandular epithelia.	2
9	Connective tissue – definition, origin, characteristics and classification. Cells of the connective tissue.	2
10	Connective tissue – extracellular matrix. Tissue fluid. Connective tissue proper (loose, dense). Mucous tissue. Elastic tissue. Reticular tissue. Adipose tissue.	2
11	Cartilagenous and osseous connective tissue. Chondrogenesis and osteogenesis.	2
12	Blood. Hemopoiesis.	3
13	Immune system.	2
14	Muscle tissue – definition, classification, origin and characteristics. Skeletal muscle tissue.	2
15	Cardiac muscle tissue. Smooth muscle tissue. Diffuse muscle cells with contractile functions (myoepithelial cells, myofibroblasts, myoid cells).	2
16	Nerve tissue – definition, classification of the cells, origin and characteristics. Neurons (nerve cells) – type, structure and functions. Neurosecretory cells. Paraneurons.	2
17	Neuroglia – types structure and functions. Nerve fibers. Nerve endings.	2
18	General embryology. Introduction to embryology. Meiosis and gametogenesis. Progenesis –spermatogenesis. Regulation. General organization of the male reproductive system.	2
19	Progenesis - ovogenesis. General organization of the ovary, the uterine tube and the uterus. Menstrual cycle in human endometrium. Hormonal regulation of the ovarian and endometrial functions.	2
20	Semen (seminal fluid). Insemination. Sperm migration in the female reproductive tract. Transport of the II order oocyte after ovulation. Ist and IInd week of the human development. Assisted reproductive technology.	2
21	IIIrd week of the human development (gastrulation).	2
22	IVth-VIIIth weeks of the development. Derivatives of ectoderm, mesoderm, endoderm. External view of the human embryo (IInd month). Embryonic and fetal membranes. Placentation and placenta. Umbilical cord. Twins and multiple births. Congenital abnormalities and malformation.	2
	Total hours	45

Practical exercises (seminars) – topics

Winter semester		
№	**Topic**	**Hours**
1.	Microscope - light and electron microscopes. Structure and proper use of the light microscope. Histological technique.	3
2.	CELL. External morphology of the cell.	3
3.	Internal morphology of the cell. Common type of organelles: plasma membrane and glycocalyx (cell coat), endoplasmic reticulum, ribosomes, Golgi apparatus, lysosomes, peroxisomes, mitochondria.	3
4.	Internal morphology of the cell: cytoskeleton (microfilaments, intermediate filaments, microtubules), centrioles. Specialized structures with plasma membrane participation on the apical, lateral and basal surface of the cell: microvilli, stereocilia, cilia and flagella, tight junctions (zonula occludens), desmosomes (macula adherens), junctional complex, gap junctions, interdigitations, canaliculi, hemidesmosomes, basal infoldings.	3
5.	Internal morphology of the cell – cell nucleus in interphase. Specific cellular organelles (myofibrils, secretory granules, synaptic vesicles, melanin granules). Cell inclusions.	3
6.	REVISION ON CYTOLOGY. Tissues. Epithelial tissue. Covering epithelia. Single-layer epithelia	3
7.	Epithelial tissue. Transitional epithelia. Multi-layer epithelia. Glandular epithelia.	3
8.	Connective tissue. Loose, collagenous, elastic, reticular and adipose tissue. Cartilaginous and osseous tissue.	3
9.	Blood. Hemopoiesis.	3
10.	Muscle tissue.	3
11.	Nerve tissue. I. Neurons (nerve cells). Neuroglia.	3
12.	Nerve tissue. II. Nerve fibers. Nerves endings.	3
13.	REVISION ON GENERAL HISTOLOGY. Embryology. Formation and development of the human embryo. Progenesis: spermatogenesis.	3
14.	Formation and development of the human embryo. Progenesis: ovogenesis. Menstrual cycle - morphological changes in the endometrium.	3
15.	Ist-VIIIth week of the human development. Bilaminar and trilaminar embryonic disk. Gastrulation. Primitive (Hensen's) node. Primitive streak. Neurulation. Notochord. Somites. Sclerotomes. Myotomes. Dermatomes. Embryonic and fetal membranes. Placentation and placenta. Umbilical cord. REVISION ON EMBRYOLOGY	3
	Total hours	**45**

Questionary

CYTOLOGY, GENERAL HISTOLOGY AND EMBRYOLOGY

Specialty "Medicine"

Educational and qualification degree "MASTER",

CYTOLOGY

1. Concept of life. Living matter - essential characteristics. Cell - definition and general data. Fundamentals of cell theory.
2. Cytological and histological research methods.
3. Chemical composition and hierarchy in the organization of the cell.
4. External morphology of the cell.
5. Classification and general characteristics of cell structures.
6. Biomembranes - characteristic, meaning, relationships and functions.
7. Plasmalemma. Glycocalyx.
8. Cellular matrix.
9. Endoplasmic reticulum.
10. Golgi apparatus (complex).
11. Lysosomes. Peroxisomes.
12. Mitochondria.
13. Cell nucleus in interphase - general data, chemical composition, optical-microscopic and electron-microscopic characteristics.
14. Chromosomes. Human karyotype.
15. Ribosomes. Polysomes.
16. Cell skeleton - microfilaments, intermediate filaments and microtubules.
17. Derivatives of microtubules - centrioles, basal bodies, cilia and flagella.
18. Specialized structures involving the plasmalemma on the apical, contact and basal surfaces of the cell (without cilia and flagella).
19. Specific cell organelles.
20. Cellular inclusions.
21. Transmembrane, intracellular and transcellular transport. Endocytosis and exocytosis.
22. Exchange of substances. Assimilation and dissimilation. Biosynthesis and secretion.
23. Cell signaling.
24. Life cycle of the cell.
25. Cell growth and differentiation.
26. Cell reproduction. Mitosis and amitosis.
27. Intracellular and cellular movements.
28. Irritability and reactivity of the cell.
29. Aging and cell death. Apoptosis.

GENERAL HISTOLOGY

30. Tissues – definition, classification, origin and general properties.
31. Epithelial tissue – definition, classification, origin, characteristics and functions.
32. Covering epithelia – definition, classification, distribution and histophysiology.

33. Exocrine glandular epithelia – definition, classification, distribution and histophysiology.
34. Endocrine glandular epithelia - definition, forms of organization, distribution and histophysiology.
35. Connective tissue – definition, classification, origin, characteristics and functions.
36. Cells of connective tissue.
37. Extracellular matrix of connective tissue.
38. Connective tissue – mesenchyme and mucous connective tissue.
39. Connective tissue - loose connective tissue.
40. Connective tissue - collagen, elastic, reticular and adipose tissue.
41. Connective tissue - cartilaginous tissue. Chondrogenesis.
42. Connective tissue with a calcified extracellular matrix - bone tissue. Osteogenesis.
43. Blood. Lymph.
44. Hematopoiesis – embryonic, fetal and postnatal.
45. Erythrocytes. Erythropoiesis.
46. Granulocytes. Granulocytopoiesis.
47. Monocytes. Monocytopoiesis. Lymphocytes. Lymphocytopoiesis.
48. Blood platelets (incl. formation)
49. Muscle tissue – definition, classification, origin, characteristics and functions.
50. Skeletal muscle tissue.
51. Cardiac muscle tissue.
52. Smooth muscle tissue.
53. Nerve tissue – definition, cellular composition, origin, characteristics and functions.
54. Neurons (neurocytes) - classification, structure, distribution and functions.
55. Synapse. Interneuronal (interneuronal) synapses.
56. Neurosecretory cells. Paraneurons.
57. Neuroglia - types, structure, distribution and functions.
58. Nerve fibers.
59. Receptor nerve endings.
60. Effector nerve endings.

EMBRYOLOGY

61. Subject, purpose, tasks, methods and relations of general embryology with other medical disciplines.
62. Meiosis and gametogenesis. Differences between male and female meiosis. Deviations in the normal course of meiosis.
63. Sperm - structure and function. Spermatogenesis.
64. Ovogenesis.
65. Ovulation. Structure and function of the mature egg cell.
66. Cyclic changes in the endometrium of a woman.
67. Semen (seminal fluid) - formation, components and characteristics.
68. Insemination. Sperm movement in the female genital tract. Order II oocyte transport after ovulation.
69. Fertilization.
70. I week of development - fragmentation, formation of the blastocyst.

71. Implantation.
72. II week of development – differentiation of trophoblast and embryoblast.
73. II week of development – development of the extraembryonic mesoderm.
74. Assisted reproduction.
75. III week of development – gastrulation (formation of embryonic mesoderm and endoderm).
76. III week of development – formation of the notochord.
77. Growth of the germinal disc.
78. III week of development – further changes in the trophoblast.
79. III - VIII week of development - derivatives of the ectodermal germ sheet.
80. III - VIII week of development - development of the mesodermal germ layer.
81. III - VIII week of development - differentiation of the paraxial mesoderm.
82. III - VIII week of development - differentiation of intermediate mesoderm and lateral plate mesoderm.
83. Embryonic circulation.
84. III - VIII week of development - derivatives of the endodermal germ sheet.
85. External view of the embryo in the second month.
86. Embryonic and fetal membranes.
87. Placentation and placenta.
88. Umbilical cord.
89. Twins and multiple births.
90. Congenital abnormalities and malformation. Prenatal diagnosis.

Textbooks and manuals:

1. Vladimir Ovcharov, Tsv. Takeva, Cytology, general histology, general embryology, 10th ed., 2023
2. Ross M and Pawlina W. Histology. A Text and Atlas with Correlated Cell and Molecular Biology. 7th ed. Lippincott Williams & Wilkins, 2015.
3. Gartner LP and Hiatt JL. Color atlas and Textboook of Histology. 6th ed. Saunders, 2014.
4. Sadler TW. Medical Embryology. 14th ed. Lippincott, William & Wilkins, 2018.
5. Anthony L. Mescher, Junqueira's Basic Histology, Text and Atlas, 15th ed, 2018

Programme developed by: .....

/ Prof. Minko Minkov, MD, PhD /

.....

/ Chief Assistant Ruska Nenkova /

Approved by a decision of the Council of the Department of Anatomy, Histology, Embryology, Pathology, Forensic Medicine and Ethics, Protocol № 25.07.11.2023г.

Head of Department:.....
(Prof. Minko Minkov, MD, PhD)

Approved by a decision of the Council of the Faculty of Medicine, Protocol № 06.09.11.2023г.

Secretary of the Council of the Faculty of Medicine: .....
(Chief Assis. Prof. Ruska Nenkova, PhD)

UNIVERSITY "PROF. DR. ASEN ZLATAROV" - BURGAS

MEDICAL FACULTY

DEPARTMENT OF PHYSICS, BIOPHYSICS, ROENTGENOLOGY AND RADIOLOGY

Approved by!

DEAN:

/Assoc. Prof. Rumyana Yankova, PhD/

SYLLABUS

Discipline:	**PHYSICS**
Specialty:	**MEDICINE**
Professional field:	**7.1. Medicine**
Educational and qualification degree:	**MASTER**
Form of training:	**REGULAR**

Burgas, 2023

EXTRACTS FROM THE CURRICULUM

1. GENERAL PARAMETERS OF THE DISCIPLINE			
Total (academic hours):	180	**ECTS:**	6

Auditorium classes	**Non-auditorium classes**	**Auditorium ECTS**	**Non-auditorium ECTS**
90	90	3	3

Type of Discipline:	**Academic hours per week: /lectures + practices/**	*Course:*	*Semester:*
Mandatory	3 + 3	**I**	**I**

2. STUDY FORMS					
Auditorium classes:	**Academic hours**	**ECTS**	**Non-auditorium classes:**	**Academic hours**	**ECTS**
Lectures	45	1.5	**Consultation**	30	1
Practices	45	1.5	**Individual work** - Preparation for colloquium - Preparation of protocols - Preparing for the exam	15 15 30	0.5 0.5 1

3. EVALUATION AND CONTROL	
Forms of evaluation and control	**Relative share in the total score**
Session evaluation: exam	**0.4**
Semester (ongoing) assessment:	**0.6**
Forms of semester control:	
- Attendance at classes	0.25
- Ongoing testing before each practical lesson	0.125
- Active participation in classes	0.125
- Control and tests	0.25
- Defense of protocols	0.25

ANNOTATION
of the discipline "Physics"

Purpose of the course:

The discipline "PHYSICS" is intended for the students of the specialty "Medicine" at the Faculty of Medicine, in a regular form of education, graduating with the educational-qualification degree "Master" and the professional qualification "Doctor". The discipline is mandatory according to the Uniform State Requirements (USR) of Bulgaria.

The aim of this Physics course is to provide students with knowledge of the application of physics to medicine. All areas of physics can be applied to medicine (mechanics, hydrodynamics, electromagnetism, thermodynamics, geometrical and quantum optics, nuclear physics). The human body is a very complex system. Concepts of modeling in physics are applied to simulate different activities of the human body systems. The development of new instrumentation and technology used for diagnosis and also for treatments is presented.

Main tasks of the curriculum:

- Knowledge and use of physical concepts, quantities and laws applied in medical practice.
- The discipline should acquaint the students with the physical principles of physiological processes, the main methods of diagnosis and treatment of the human body, many of which require in-depth knowledge of physics.
- Evaluation the human impact of a number of natural factors important for hygiene and prevention.
- Acquaintance with the principle of operation and the working methodology of various measuring devices used in clinical practice as ultrasound echographs, lasers with medical application, conventional radiographs and radioscopes, computer X-ray and magnetic resonance tomographs, nuclear medicine diagnostic and therapeutic instrumentation, etc.

Structure of learning content:

Elements of various sections of physics are studied, which are related to clinical practice and are necessary to build the mandatory physical foundation of future physicians. Basic concepts of mechanics, hydrodynamics of ideal and real fluids are introduced and then viscosity and blood flow as well as measuring of erythrocyte sedimentation rate, blood pressure, etc. are discussed. Mechanical vibrations and waves are studied and physical and psychophysical characteristics of sound are given. Ultrasound properties and diagnostic methods are presented. Molecular physics and structure of liquids and solids; temperature and heat concepts; basic laws of thermodynamics; heat exchange; electric field, electrical conductivity of a solids; direct and alternating current; physical foundations of electrodiagnostics; physical basis of electrotherapy; magnetic field; magnetic properties of matter; electromagnetic field applications in medicine are explained. Geometrical optics, the eye as an optical system; light and electron microscopes; external and internal photoelectric effect; optical atomic and molecular spectra; luminescence; lasers; nuclear magnetic resonance; X-rays properties and X-ray diagnostics; radioactivity; interaction of photon ionizing radiation with matter; dosimetric quantities and units; radionuclide diagnostics; action of ionizing radiation on the human body – all these sections of medical physics are studied and discussed.

Teaching methods: traditional and innovative teaching methods, explanation, lecture, discussion, experiment, computer modelling, multimedia presentation, projects, case studies, incidents, teamwork, etc. To illustrate the material, the lecture presentations include schematic

diagrams, computational examples based on basic dependencies, short demonstrations of physical phenomena, devices from clinical practice, or interactive software products are used. In the practical exercises, a physical experiment is conducted, demonstrations are made and computational problems are solved experimentally.

Forms of independent work: solving problems and tests; preparation of protocols of the practical exercises, including assessment and processing of individually obtained results; working with electronic courses in physics on the Internet; work on a given project (report).

Methods of assessment: current control during the practical exercises, colloquia on the main sections of the discipline and final control - theoretical exam.

Prerequisites for students' basic knowledge and skills: students should have good knowledge in general physics from the high school course and skills to apply the apparatus of elementary mathematics to calculate physical quantities and process experimental results.

Expected results:

Upon successful completion of the course in Physics, students should have the following knowledge and skills:

- know the basic physical quantities, units and laws used in medical practice;
- make a quantitative characterization of the physiological processes by measuring the relevant physical quantities;
- know the physical principles of the main methods of diagnosis and treatment of the human body;
- make a comparative assessment of the types of diagnostic equipment in terms of resolution, advantages and disadvantages compared to other research methods and field of application;
- evaluate the harmful factors of the environment on the human organism;
- perform physical measurements independently and present the results in tabular and graphical form, as well as to determine their uncertainty limits after their statistical processing.
- acquired practical skills: working with an audiometer; measurement of speed and volume of blood flow with a portable Doppler echograph; working with an ultrasonic analyzer; determination of viscosity of fluids; blood pressure measurement; osmotic pressure measurement; work with electrical measuring devices, function generator and oscilloscope; explanation of an electrocardiogram; study of the distribution of biological objects using a light microscope; determination of refractive index with a refractometer; determination of concentration of solutions with a photocolourimeter; working with a polarimeter and measuring the concentration of sugar solutions, etc.

CURRICULUM CONTENT

LECTURES

Topic	Hours
1. **Basic concepts of fluid mechanics.** Hydrostatics. Pascal's law. Hydrodynamics. Motion of ideal and real fluids. Viscosity. Laminar and turbulent motion. Blood pressure measurement. Phase separation in liquid heterogeneous systems - sedimentation, centrifugation, filtration. Newtonian and non-Newtonian fluids. Viscosity of solutions and suspensions. Blood viscosity. Erythrocyte sedimentation rate (ESR). Dynamics of erythrocyte centrifugation in blood plasma. Inertial and non-inertial reference systems. Rotation. Action of inertial forces on man.	3
2. **Sound**. Mechanical oscillations and waves. Sound waves. Physical characteristics of sound: pressure, intensity, frequency, wavelength, propagation speed, impedance, spectrum. Tone, noise and shockwaves. Extracorporeal lithotripsy. Psychophysical characteristics of sound. Hearing area. Loudness level and intensity level. Pitch and timbre. Hearing parameters. Physical mechanism of hearing aid action in man. Principles of noise protection. Acoustic methods for diagnosis and treatment. Ultrasound (US). Physical properties. US generators and detectors. Imaging diagnostics with US-techniques. The Doppler effect and examination. US therapy.	3
3. Molecular physics and thermodynamics. Kinetic molecular theory of gases. Gas laws. Phase diagrams. Physical properties of liquids. Surface tension and capillary action. Gas and fat embolism. Molecular structure of matter. Mechanical properties of solids. Types of deformations. Stress strain curve. Mechanical properties of biological tissues.	2
4. Atmosphere and air. Atmospheric pressure. Influence of atmospheric pressure on man. Role of surfactants in volume stability of alveoli. Static and dynamic volumes and capacities.	2
5. Temperature and heat. Temperature scales. Thermal expansion. Principles of thermodynamics. Transport phenomena: diffusion (hemodialysis), thermal conductivity, internal friction Types of heat exchange, laws. Thermoregulation in humans. Application of heat and cold in medicine.	4
6. Electricity. Electrostatic field. Polarization of dielectrics. Electric capacitance. Electrical conductivity of solids. Band theory. Electrical conductivity of metals. Intrinsic and impurity conductivity of semiconductors. Application of semiconductors in medicine. Direct current. Electric conductivity of electrolytes. Principle of medicinal electrophoresis. Batteries. Electric current in gases. Aeroions and aeroionotherapy.	3
7. **Magnetic field**. Magnetic induction. Magnetic field strength. The Biot-Savart law. Forces on currents in magnetic fields. Electromagnetic induction. Electromagnetic field. Alternating current. Basic values of alternating electric current. Alternating current in biological objects. Physical principles of electrical safety.	3
8. Physical foundations of **electric diagnostics and therapy**. Propagation of action potential. Electrocardiography (ECG). Electromyography (EMG), electroencephalography (EEG), electrogastrography (EGG). Direct and alternating current electrotherapy.	3

10. Biomagnetism and magnetobiology. Magnetic properties of substances. Physical nature of magnets – diamagnetism, paramagnetism and ferromagnetism. Magnetocardiography (MCG). Magnetotherapy. Electron Paramagnetic Resonance (EPR). The physics of NMR. Magnetic resonance imaging diagnostics (MRI or MRT).	2
11. Optics. Electromagnetic nature of light. EM spectrum. Photometric quantities and units. Geometrical optics. Optical fibers, cables, endoscopes. Polarized light. Interaction between light and matter: dispersion, absorption, light scattering. Nephelometry. UV and IR light in medicine. Lens parameters. Aberrations. Light microscope. Resolution of human eye and optical instrument. Microscopic observation techniques in clinical practice. Optical system of the eye. Refractive media and refractive power of the eye. Eye defects and correction. Dioptrometry. Perceptual system of the eye - spectral sensitivity.	6
12. Quantum optics. Electronic microscope. Thermal radiation. Solar radiation. Infrared diagnostics and therapy. Thermography. UV bands and properties. Types of optical transitions. Atomic and molecular spectra. Luminescence. External and internal photoelectric effect. Lasers. Parameters of laser radiation. Types of lasers. Application in medicine for diagnosis and therapy.	4
13. Ionizing radiation. Classification. Radioactivity. Alpha- and beta- radioactive conversion. Gamma rays. Interaction of charged particles with matter. X-rays. Interaction of photon ionizing radiation with matter. Dosimetric quantities and units. Equivalent dose Weighting factor. Tissue weighting factor and effective dose. Measuring devices.	3
14. X-ray diagnostics. Interaction of X-ray with matter. Methods of diagnostics. X-ray computed tomography. Biological effects of radiation. Radiation protection standards.	3
15. Nuclear medicine. Radionuclide generators. Common positron emitting radionuclides. PET/computed tomography. Advantages of PET/CT machines. Therapy with photon and corpuscular ionizing beams: deep X-ray therapy, telegamma therapy with ^{60}Co. LINACs generations. Brachytherapy. Radiosurgical techniques - gamma knife, linac based surgery, cyberknife. Hadrontherapy: n, p and heavy-ion beams. Radiation protection and safety in radiotherapy.	5
Total academic hours	45

PRACTICAL EXERCISES

Topic	Hours
1. Measurements of Physical quantities and Introduction to the Theory of Errors	3
2. Atmospheric Pressure. Humidity	3
3. Measurement of Blood Pressure	3
4. Determination of the Dynamic Coefficient of Liquids. Erythrocyte Sedimentation Rate. Rate of Dust Sedimentation	3
5. Determination of the Density of Solids and Liquids with a Pycnometer	3
6. Osmometer with Natural and Artificial Cylindrical Membrane **Colloquium I**	2 1
7. Determination the Spectral Characteristic of the Ear at the Hearing Threshold	3
8. Doppler Effect. Measurement of Particle Flow Velocity and Blood Flow Velocity	3
9. Electric Signals	3
10. Electrocardiogram	3
11. Determination of the Optical Power of Optical Lenses. The Eye as the Optical System	3
12. Measuring the Average Size of Micro-objects with a Microscope	3
13. Investigation of the Law of the Distribution of Biological Micro-objects to their Size Colloquium II.	2 1
14. Polarized Light. Determination of the Concentration of Optically Active Substances with the Polarimeter of Loran.	3
15. Basic Quantities in Medical Radiology.	3
Total academic hours	**45**

Background of Physics Examination
for students of the specialty "Medicine"

1. Hydrostatics. Pascal's law. Hydrodynamics. Motion of ideal fluids. Motion of real fluids. Viscosity. Laminar and turbulent motion. Blood pressure measurement.
2. Phase separation in liquid heterogeneous systems - sedimentation, centrifugation, filtration. Newtonian and non-Newtonian fluids. Viscosity of solutions and suspensions. Blood viscosity. Erythrocyte sedimentation rate (ESR). Dynamics of erythrocyte centrifugation in blood plasma. Inertial and non-inertial reference systems. Rotation. Action of inertial forces on man.

3. Mechanical oscillations and waves. Sound waves. Physical characteristics of sound: pressure, intensity, frequency, wavelength, propagation speed, impedance, spectrum. Tone, noise and shockwaves. Extracorporeal lithotripsy.
4. Psychophysical characteristics of sound. Hearing area. Loudness level and intensity level. Pitch and timbre. Hearing parameters. Physical mechanism of hearing aid action in man. Principles of noise protection. Acoustic methods for diagnosis and treatment - auscultation, percussion phonocardiography. Audiometry, auditory prosthetics.
5. Ultrasound (US). Physical properties. US generators and detectors. Imaging diagnostics with US-techniques. The Doppler effect and examination. US therapy.
6. Molecular physics and thermodynamics. Kinetic molecular theory of gases. Phase Diagrams. Physical properties of liquids. Surface tension and capillary action. Gas and fat embolism.
7. Molecular structure of matter. Mechanical properties of solids. Types of deformations. Stress strain curve. Mechanical properties of biological tissues.
8. Atmospheric pressure. Influence of atmospheric pressure on man. Role of surfactants in volume stability of alveoli. Static and dynamic volumes and capacities.
9. Temperature and heat. Temperature scales. Thermal expansion. Principles of thermodynamics.
10. Transport phenomena: diffusion (hemodialysis), thermal conductivity, internal friction Types of heat exchange, laws. Thermoregulation in humans. Application of heat and cold in medicine.
11. Electric charge. Electrostatics. Electric field strength and electric potential. Electric properties of substances. Polarization of dielectrics. Electric capacitance. Capacitors.
12. Electrical conductivity of solids. Band theory. Electrical conductivity of metals. Direct current. Intrinsic and impurity conductivity of semiconductors. Application of semiconductors in medicine. Direct current. Ohm's law. Microscopic view. Ohm's law for the part and entire circuit.
13. Electrical conductivity of electrolytes. Faraday's laws of electrolysis. Principle of medicinal electrophoresis. Electrochemical cells. Operating parameters of the batteries. Electric current in gases. Aeroions and aeroionotherapy.
14. Magnetic field. Magnetic induction. Magnetic field strength. The Biot-Savart law. Forces on currents in magnetic fields. Electromagnetic induction. Electromagnetic field.
15. Alternating current. Basic values of alternating electric current. Alternating current in biological objects. Physical principles of electrical safety.
16. Physical foundations of electrodiagnostics. Propagation of action potential. Electrocardiography (ECG). Electromyography (EMG), electroencephalography (EEG), electrogastrography (EGG). Direct and alternating current electrotherapy.
17. Magnetic properties of substances. Physical nature of magnets – diamagnetism, paramagnetism and ferromagnetism. Magnetocardiography (MCG). Magnetotherapy.
18. Electron Paramagnetic Resonance (EPR). The physics of NMR. Magnetic resonance imaging diagnostics (MRI or MRT).
19. Optics. Electromagnetic nature of light. EM spectrum. Photometric quantities and units. Geometrical optics. Optical fibers, cables, endoscopes. Polarized light.
20. Interaction between light and matter. Dispersion, Absorption of light, photocolorimetry. Light scattering. Nephelometry. UV and IR light in medicine.
21. Spherical lenses – types. Thin and thick lenses. Lens parameters. Aberrations. Light microscope. Resolution of human eye and optical instrument. Microscopic observation techniques in clinical practice.
22. Optical system of the eye. Refractive media and refractive power of the eye. Eye defects and correction. Dioptrometry. Perceptual system of the eye - spectral sensitivity.

23. Quantum physics. De Broglie waves. Electronic microscope. Thermal radiation. Solar radiation. Infrared diagnostics and therapy. Thermography. UV bands and properties.
24. Types of optical transitions. Atomic and molecular spectra. Luminescence. External and internal photoelectric effect. Photoconverters, types.
25. Lasers. Normal and inverse population; spontaneous and stimulated emission. Schematic diagram of a laser. Parameters of laser radiation. Types of lasers. Application in medicine for diagnosis and therapy.
26. Ionizing radiation. Classification. Radioactivity. Alpha- and beta- radioactive conversion. Gamma rays. Interaction of charged particles with matter. X-rays. Interaction of photon ionizing radiation with matter.
27. Dosimetry of ionizing radiation. Dosimetric quantities and units. Equivalent dose Weighting factor. Tissue weighting factor and effective dose. Measuring devices.
28. Imaging diagnostics methods. Interaction of X-ray with matter. Methods of X-ray diagnostics. X-ray computed tomography. Biological effects of radiation. Radiation protection standards.
29. Physical basis of radionuclide diagnostics. Radionuclide generators. Common positron emitting radionuclides. PET/computed tomography. Advantages of PET/CT machines.
30. Therapy with photon and corpuscular ionizing beams: deep X-ray therapy, telegamma therapy with 60Co. LINACs generations. Brachytherapy. Radiosurgical techniques - gamma knife, linac based surgery, cyberknife. Hadrontherapy: n, p and C-ion beams. Radiation protection and safety in radiotherapy.

BIBLIOGRAPHY

1. Marinov M., Medical Physics, Union of Physicists in Bulgaria, Sofia, 2007.
2. Todorov V., Medical Physics, Medicine and physical education, Sofia, 1995.
3. Sultanova N., Physics, Prof. Dr. Assen Zlatarov University, Bourgas, 2014.
4. Medical Physics, Lectures in General Physics for Medical Sciences Students, available from https://www.researchgate.net/publication/321319390 .
5. An Introduction to Medical Physics, Editor Muhammed Maqbool, © Springer International Publishing AG 2017.
6. Radiation Oncology Physics: A Handbook for Teachers and Students , International Atomic Energy Agency, Vienna, 2005.
7. Nikolaeva, Z., N. Sultanova, St. Kasarova, Z. Dimitrova, Manual for laboratory exercises in physics, University "Prof. Dr. Asen Zlatarov", Burgas, (2015).
8. Nikolaeva, Z., A. Petrakiev, Z. Dimitrova, V. Georgieva, Manual for laboratory exercises in biophysics and biophysical methods for purification, University "Prof. Dr. Asen Zlatarov", Burgas, (2006).
9. Alexandrova, M., Manual for Laboratory Exercises and Workbook in Medical Physics, Medical University, Pleven, ISBN 978-954-756-245-5, 2020.
10. Bechev, B., D. Vladimirova, etc. Medical Physics, Exercise Book, TEMTO, ISBN 978-954-9566-73-4, 2014.

Students are encouraged to use any other available textbook in Medical Physics covering the above topics.

Compiled by:

(Prof. Dr. Nina Sultanova)

Practical exercises compiled by:

(Assoc. Prof. Dr. Zdravka Nikolaeva)

Approved by a decision of the Council of the Department of Physics, Biophysics, Roentgenology and Radiology, Protocol № 19/ 7.11.2023

Head of Department .....

(Assoc. Prof. Dr. Stefka Kasarova)

Approved by a decision of the Faculty Council of the Medical Faculty, Protocol № 46/09.11.23г.

Secretary of the Council of the Medical Faculty: ....

(Chief assist. Prof. Ruska Nenkova, PhD)

UNIVERSITY "PROF. DR. ASEN ZLATAROV" - BURGAS

MEDICAL FACULTY

DEPARTMENT OF PHYSIOLOGY, PATHOPHYSIOLOGY, CHEMISTRY AND BIOCHEMISTRY

Approved by!

DEAN:

/Assoc. Prof. Rumyana Yankova, PhD/

SYLLABUS

Discipline:	**CHEMISTRY**
Specialty:	**MEDICINE**
Professional field:	**7.1. Medicine**
Educational and qualification degree:	**MASTER**
Form of training:	**REGULAR**

Burgas, 2023

EXTRACTS FROM THE CURRICULUM

1. GENERAL PARAMETERS OF THE DISCIPLINE			
Total (academic hours):	210	**ECTS:**	7
Auditorium classes	**Non-auditorium classes**	**Auditorium ECTS**	**Non-auditorium ECTS**
90	120	3	4
Type of Discipline:	**Academic hours per week: /lectures + practices/**	*Course:*	*Semester:*
Mandatory	3 + 3	**I**	**I**

2. STUDY FORMS					
Auditorium classes:	**Academic hours**	**ECTS**	**Non-auditorium classes:**	**Academic hours**	**ECTS**
Lectures	45	1.5	**Consultation**	30	1
Practices	45	1.5	**Individual work** - Preparation for colloquium - Preparation of protocols - Preparing for the exam	35 15 40	1.2 0.5 1.3

3.EVALUATION AND CONTROL	
Forms of evaluation and control	**Relative share in the total score**
Sessional evaluation: exam	**0.4**
Semester (ongoing) assessment:	**0.6**
Forms of semester control:	
- Attendance at classes	0.25
- Ongoing testing before each practical lesson	0.125
- Active participation in classes	0.125
- Control and tests	0.25
- Defense of protocols	0.25

ANNOTATION
of the discipline "Chemistry"

Purpose of the course:

The course "Chemistry" is designed for students of the specialty "Medicine", full-time form of study.

The aim of the Chemistry course is to provide students with knowledge of the basic chemical processes underlying metabolism, biological oxidation and related energy conversion, and the regulation, control and integration of chemical processes in organisms. The study of the chemical aspects of the molecular basis of life provides insights into the composition, structure and function of cellular components, into the chemical reactions and processes occurring in cells and their regulation, and explains their significance for the organism in norm and pathology. This approach is necessary for understanding and mastering the biochemical processes of the human body, pharmacology, clinical medicine and physiology, for discovering the causes of disease and prescribing therapy.

Main tasks of the curriculum:

Mastery of basic chemical concepts concerning the characteristics of metabolic processes in the body, in particular: buffer systems, enzymes, biological oxidation, chemical aspects of carbohydrate, amino acid and lipid metabolism; basic types of heterocyclic compounds and their biologically active derivatives. Introduction to instrumentation for the analysis of biological objects.

Structure of learning content:

- Chemical bond and structure of the molecule.
- Dispersion systems.
- Chemical kinetics and chemical equilibrium.
- Redox processes and redox systems.
- Hydrocarbons.
- Hydroxyl derivatives of hydrocarbons and thiols.
- Carbonyl derivatives of hydrocarbons.
- Carboxylic acids.
- Amino derivatives.
- Amino acids and peptides.
- Carbohydrates.
- Lipids.
- Heterocyclic compounds.

Teaching methods: traditional and innovative teaching methods, explanation, lecture, discussion, experiment, computer modelling, multimedia presentation, projects, case studies, incidents, teamwork, etc.

Forms of independent work: coursework of a referential type, problems for independent solving on topics from practical classes, written control work on sections of the curriculum, solving tests, elaboration of protocols for laboratory exercises, colloquia.

Methods of assessment: current control during the classes, colloquia on the main sections of the discipline and final control - theoretical exam.

Prerequisites for students' basic knowledge and skills:

Students should have a good basic knowledge of high school chemistry and the ability to work with substances, laboratory vessels and apparatus.

Expected results:

Upon successful completion of the course, students should have the following knowledge and skills:

- Understand the meaning and content of concepts such as concentration of solutions, reaction to the medium (and its determination), the importance and action of buffer systems in the body.
- To know the classification, structure and chemistry of biocatalysts.
- Know the nature of redox processes in the body (biological oxidation) and the basic principles of biological metabolism.
- Know the type of macroergic compounds and their place in metabolism.
- Know the chemical aspect of carbohydrate, amino acid and lipid metabolism.
- Know the main types of heterocyclic compounds and especially the biologically active substances based on them (enzymes, vitamins and hormones).
- To know the type of analysis devices used during the practical classes, to be familiar with their capabilities for the analysis of biological objects.
- To have the skills necessary to find solutions to specific problems, to perform basic operations and procedures to influence the objects under study, to work with laboratory equipment and apparatus, to observe health and safety conditions.
- To have acquired competences for scientific explanation of facts and phenomena, for application of experimental results, competences for observation, modelling, analysis, development of logical and creative thinking, development of independence, teamwork, self-control.

CURRICULUM CONTENT

LECTURES

Topic	hours
1. Chemical bond and structure of the molecule. 1.1. Nature of the chemical bond. Covalent bond. Method of valence bonds. Hybridization of atomic orbitals. Delocalized chemical bond. Method of molecular orbitals. 1.2. Ionic bond. Intermolecular interactions. Hydrogen bond - nature, types, meaning. Role of hydrogen bonds in stability and structure formation of molecules. Biological role. 1.3. Coordination compounds. Donor-acceptor (coordinative) bond. Classification and nomenclature. Spatial structure and isomerism. Stability of the complex ion. Chelates - biological significance.	3
2. Dispersion systems. 2.1. Solutions and solubility. Concentration of solutions. Solutions of weak and strong electrolytes. Equilibrium in solutions of weak electrolytes - dissociation constant. Strong electrolytes - activity and ionic strength. Equilibrium in solutions of weakly soluble ionic compounds - solubility product.	8

2.2. Colligative properties of dilute solutions: vapour pressure, boiling point, freezing point. Diffusion and osmosis. Biological significance. 2.3. Protolysis processes. Brønstedt and Lowry's notions of acids and bases. Strength of protoliths - pK_a and pK_b . Factors on which the strength of protoliths depends. Lewis's notions of acids and bases. 2.4. Hydrolysis processes. Hydrolysis rate and hydrolysis constant. Relationship between hydrolysis constant and protolysis constants. Biological significance of hydrolysis processes. 2.5. Autoprotolysis. Ion product of water. Hydrogen index. pH scale. Methods of pH determination. Physiological pH-values. 2.6. pH of buffer solutions - Henderson-Hasselbalch equation for acidic and basic buffer solutions. Buffer capacity. Biological significance. Blood buffers. 2.7. Colloid-dispersed systems. Classification. Structure of colloidal particles. Kinetic, optical and electrical properties of colloidal solutions. Solutions of high molecular weight compounds. Stability and coagulation of colloidal solutions. Biological significance.	
3. Chemical kinetics and chemical equilibrium. 3.1. Chemical reaction rates. Law of action of masses. Rate constant. Mechanism of chemical reactions. Molecularity and order. Kinetic equations. 3.2. Effect of temperature on the rate of chemical reactions. Active complex. Activation energy - Arrhenius equation. 3.3. Criteria for determining the direction of chemical processes and the associated basic thermodynamic quantities - enthalpy, entropy, free energy. Exergonic, endergonic and energetic processes. Compressed processes. Compounds with macroergic bonds. Examples of energetic reactions in living organisms. 3.4. Reversibility of chemical processes. Chemical equilibrium. Equation of the Vant Hoff reaction isotherm. Factors affecting chemical equilibrium.	4
4. Redox processes and redox systems. 4.1. Degree of oxidation (oxidation number). Oxidation-reduction processes. Modes of electron exchange and types of redox processes. 4.2 Reversible galvanic element. Electromotive force of galvanic elements. Redox potential. Nernst equation. Relationship between redox potential and equilibrium constant. Direction of redox processes. Features of biological oxidation. 4.3 Boundary-surface phenomena. Adsorption. Adsorption equilibrium. Adsorption isotherm. Exchange and selective adsorption. Lyotropic series. Application of adsorption processes.	3
5. Hydrocarbons. 5.1. Saturated fatty hydrocarbons. Alkanes - reactivity. Mechanism of radical chain substitution reactions (S_R). Cyclohexane - chair and bath conformation, equatorial and axial substituents. Free radicals and carcinogenesis.	3

5.2. Unsaturated fatty hydrocarbons (alkenes and alkynes) - properties. Acidity of alkynes. Mechanism of electrophilic addition reactions (A_E). Oxidation and polymerization of alkenes. 5.3. Aromatic hydrocarbons - properties. Criteria for aromatic character - Hueckel's rule. Mechanism of electrophilic substitution reactions (S_E). Orientation in the benzene nucleus. Activating and deactivating substituents, electronic effects. Polynuclear aromatic hydrocarbons with fused nuclei. Concept of carcinogens.	
6. Hydroxyl derivatives of hydrocarbons and thiols. 6.1. Alcohols and phenols - general characteristics. Reactivity, acidity and basicity. Chemical properties of alcohols and phenols. Biooxidation of methanol, ethanol and ethylene glycol. Toxicity of phenol. 6.2. Thioalcohols (mercaptans) - acid properties and oxidation reactions.	2
7. Carbonyl derivatives of hydrocarbons. Aldehydes and ketones - reactivity. Chemical properties. Mechanism of nucleophilic addition reactions(A_N). Oxidation-reduction reactions. Polymerization and polycondensation reactions. Role of aldol condensation in biological processes. Canicaro reaction. Major representatives of aldehydes and catenates. Quinones - structure and properties.	3
8. Carboxylic acids. 8.1. Monocarboxylic acids. Saturated and aromatic monobasic acids. More important representatives: formic, acetic, propionic, butyric, valerian and benzoic acids. Chemical properties. Relationship between structure and acidity (pKa). 8.2. Unsaturated monocarboxylic acids. Chemical properties and representatives: acrylic, methacrylic and oleic acids. Essential higher unsaturated fatty acids - linoleic, linolenic, arachidonic, eicosapentaenoic and docosahexaenoic acids (vitamin F). Role of ω-3 polyunsaturated acids in cardiovascular disease prevention. 8.3. Saturated dicarboxylic acids - properties and representatives (oxalic, malonic, succinic, glutaric, adipic acids). Unsaturated dicarboxylic acids - maleic and fumaric acids. Aromatic dicarboxylic acids - phthalic, isophthalic and terephthalic acids. 8.4. Hydroxycarboxylic acids (fatty and aromatic) - structure and properties. Representatives - lactic acid, β-hydroxybutyric acid, tartaric, citric and salicylic acids. Drugs - derivatives of salicylic acid. 8.5. Aldehyde- and ketocarboxylic acids - structure and properties. More important representatives - glyoxalic, pyruvic, acetoacetic, oxaloacetic acids. Acids involved in the Krebs cycle. Ketone bodies - biological significance. 8.6. Carbonic acid and derivatives - uric acid, urethanes, urea, ureides, biuret, guanidine, creatine, creatine phosphate, creatinine. Biological significance.	6
9. Amino derivatives. Amines. Fatty and aromatic amines. Basic nature of amines (pK_b). Physical and chemical properties. Biogenic amines. Amides of medicinal importance - phenacetin and paracetamol. Biologically important amino alcohols - collamine, choline.	2

Acetylcholine - biological role. Catecholamines - dopamine, adrenaline, noradrenaline.	
10. Amino acids and peptides. 10.1. Amino acids - classification, representatives. Essential amino acids. Chemical properties - reactions associated with the amine and carboxyl group. Heating behavior. Lactam-lactam tautomerism. Biological significance of amino acids. 10.2. Peptides - peptide bond stereochemistry. Biologically important peptides - glutathione, vasopressin, oxytocin, insulin.	2
11. Carbohydrates. 11.1. Carbohydrates. Classification. Monosaccharides - structure, representatives (mannose, galactose, fructose, ribose and deoxyribose), stereoisomerism. Semi-acetal forms of monosaccharides. Structure of vitamin **C** and its role as an antioxidant. 11.2. Chemical properties of monosaccharides - oxidation reactions, reduction to polyvalent alcohols, reactions for carbonyl and hydroxyl groups. Biologically important esters. Alkylation and formation of glycosides. 11.3. Disaccharides. Types of binding of monosaccharide residues. Reducing and non-reducing disaccharides - structure and properties. Homopolysaccharides and heteropolysaccharides - structure and properties. Representatives.	2
12. Lipids. 12.1. Lipids - classification. Hydrolyzable lipids - structure, properties, representatives. Chemical aspects of biological oxidation of fats. Phospholipids - types and biological significance. 12.2. Non-hydrolyzable lipids. Terpenes and steroids. More important representatives of biological importance - carotene and retinol (vit. A). Retinal - chemical aspects of visual perception. Cholesterol and vitamin D.	1
13. Heterocyclic compounds. 13.1. Heterocyclic compounds - classification. Heterocyclic compounds with a pentatomic ring and one heteroatom (furan, pyrrole, thiophene). Structure and chemical properties. Biologically active substances with pyrrole structure. 13.2. Heterocyclic compounds with a pentatomic ring and two heteroatoms (pyrazole, imidazole and thiazole). Structure and more important chemical properties. Biologically active substances with pyrazole, imidazole and thiazole structures. 13.3 Heterocyclic compounds with a hexatoms ring and one heteroatom (pyridine). Structure and basic chemical properties. Biologically active substances with pyridine structure. 13.4. Heterocyclic compounds with a six-atom ring and two heteroatoms. Pyrimidine. Barbituric acid and barbiturates. Pyrimidine bases - cytosine, uracil, thymine. 13.5 Bicyclic heterocyclic compounds with fused nuclei. Pteridine - structure and properties. Purine group. Structure and properties of purine. Oxygen derivatives of purine - hypoxanthine, xanthine and picric acid. Purine bases - adenine and guanine.	6

13.6. Nucleic acids (DNA and RNA) - concept. Alkaloids - general characteristics. Nicotine, atropine, cocaine, quinine and morphine. Morphine derivatives - codeine and heroin. Physiological action.	
Total:	**45 hours**

OPERATIONS

Topic	Hours
1. Rules for work in the laboratory. Safety technique. Solutions. Concentration of solutions - types. Conversion of molar to normal concentration. Preparation of solutions of specified concentration.	3
2. Acid-base interactions. Brønsted-Lowry theory. Protolysis constants. Hydrogen index. Methods for calculating and measuring the pH of solutions. Acid-base indicators and pH-meters.	3
3. Buffers. Definition and biological significance. Henderson-Hasselbach equation. Preparation of buffers.	3
4. Redox interactions. Oxidants as disinfectants in medical practice. Potassium permanganate - application in medicine and analytical chemistry. Permanganometry.	3
5. Complexation processes. EDTA - structure and properties of polydentate ligand. Chelate complexes. Experimental determination of total water hardness.	3
6. Rate of chemical reactions. Law of action of masses. Rate constant. Effect of temperature on the rate of chemical reactions. Dependence of chemical reaction rates on the concentration of reactants.	3
7. Reversibility of chemical processes. Chemical equilibrium. Equation of the reaction isotherm of Vant Hoff. Factors affecting chemical equilibrium. Preparation of potassium chromate.	3
8. Colloquium I.	3
9. Hydroxyl derivatives. Comparative consideration of alcohols and phenols. Analytical reactions in glycerol and phenol.	3
10. Carbonyl derivatives. Reactivity of aldehydes and ketones. Mechanism of A_N reactions. Analytical reactions for aldehyde group, aldol condensation, Canizzaro reaction, detection of acetone in urine - Legall's sample.	3
11. Carboxyl derivatives. Acidic properties - protolysis constants. Mechanism of S_N reactions. Esterification. Decarboxylation.	3
12. Amines. Basic properties - protolysis constants. Comparison of fatty and aromatic amines. Interaction with nitrous acid.	3
13. Amino acids. Essential α-amino acids. Isoelectric point. Peptides. Structure of a peptide bond.	3
14. Carbohydrates. Monosaccharides - structure, optical activity and chemical properties. Relation of glucose and fructose to weak oxidants. Reducing and non-reducing disaccharides. Polysaccharides.	3
15. Colloquium II.	3
Total:	45 hours

BACKGROUND
for Chemistry exam
for students of the specialty "Medicine"

1. Nature of the chemical bond. Covalent bond. Method of valence bonds. Hybridization of atomic orbitals. Delocalized chemical bond. Method of molecular orbitals.

2. Ionic bond. Intermolecular interactions. Hydrogen bond - nature, types, meaning. Role of hydrogen bonds in stability and structure formation of molecules. Biological role.

3. Coordination compounds. Donor-acceptor (coordinative) bond. Classification and nomenclature. Spatial structure and isomerism. Stability of the complex ion. Chelates - biological significance.

4. Solutions and solubility. Concentration of solutions. Solutions of weak and strong electrolytes. Equilibrium in solutions of weak electrolytes - dissociation constant. Strong electrolytes - activity and ionic strength. Equilibrium in solutions of weakly soluble ionic compounds - solubility product.

5. Colligative properties of dilute solutions: vapour pressure, boiling point, freezing point. Diffusion and osmosis. Biological significance.

6. Protolysis processes. Brönsted and Lowry's notions of acids and bases. Strength of protoliths - pK_a and pK_b . Factors on which the strength of protoliths depends. Lewis's notions of acids and bases.

7. Hydrolysis processes. Degree of hydrolysis and hydrolysis constant. Relationship between hydrolysis constant and protolysis constants. Biological significance of hydrolytic processes.

8. Autoprotolysis. Ion product of water. Hydrogen index. pH scale. Methods of pH determination. Physiological pH-values.

9. pH of buffer solutions - Henderson-Hasselbalch equation for acidic and basic buffer solutions. Buffer capacity. Biological significance. Blood buffers.

10. Colloid-dispersed systems. Classification. Structure of colloidal particles. Kinetic, optical and electrical properties of colloidal solutions. Solutions of high molecular weight compounds. Stability and coagulation of colloidal solutions. Biological significance.

11. Chemical kinetics. Rate of chemical reactions. Law of action of masses. Rate constant. Mechanism of chemical reactions. Molecularity and order. Kinetic equations.

12. Effect of temperature on the rate of chemical reactions. Active complex. Activation energy - Arrhenius equation.

13. Criteria for determining the direction of chemical processes and related basic thermodynamic quantities - enthalpy, entropy, free energy. Exergonic, endergonic and energetic processes. Compressed processes. Compounds with macroergic bonds. Examples of energetic reactions in living organisms.

14. Reversibility of chemical processes. Chemical equilibrium. Equation of the reaction isotherm of Vant Hoff. Factors affecting chemical equilibrium.

15. Degree of oxidation (oxidation number). Oxidation-reduction processes. Modes of electron exchange and types of redox processes.

16. Reversible galvanic element. Electromotive force of galvanic elements. Redox potential. Nernst equation. Relationship between redox potential and equilibrium constant. Direction of redox processes. Features of biological oxidation.

17. Boundary-surface phenomena. Adsorption. Adsorption equilibrium. Adsorption isotherm. Exchange and selective adsorption. Lyotropic series. Application of adsorption processes.

18. Saturated fatty hydrocarbons. Alkanes - reactivity. Mechanism of radical chain substitution reactions (S_R). Cyclohexane - "chair" and "tub" conformation, equatorial and axial substituents. Free radicals and carcinogenesis.

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20. Aromatic hydrocarbons - properties. Criteria for aromatic character - Hueckel's rule. Mechanism of electrophilic substitution reactions (S_E). Orientation in the benzene nucleus. Activating and deactivating substituents, electronic effects. Polynuclear aromatic hydrocarbons with fused nuclei. Concept of carcinogens.

21. Alcohols and phenols - general characteristics. Reactivity, acidity and basicity. Chemical properties of alcohols and phenols. Biooxidation of methanol, ethanol and ethylene glycol. Toxicity of phenol.

22. Thioalcohols (mercaptans) - acidic properties and oxidation reactions.

23. Aldehydes and ketones - reactivity. Chemical properties. Mechanism of nucleophilic addition reactions(A_N). Oxidation-reduction reactions. Polymerization and polycondensation reactions. Role of aldol condensation in biological processes. Canicaro reaction. Major representatives of aldehydes and catenates. Quinones - structure and properties.

24. Monocarboxylic acids. Saturated and aromatic monobasic acids. More important representatives: formic, acetic, propionic, butyric, valerian and benzoic acids. Chemical properties. Relationship between structure and acidity (pKa).

25. Unsaturated monocarboxylic acids. Chemical properties and representatives: acrylic, methacrylic and oleic acids. Essential higher unsaturated fatty acids - linoleic, linolenic, arachidonic, eicosapentaenoic and docosahexaenoic acids (vitamin F). Role of ω-3 polyunsaturated acids in cardiovascular disease prevention.

26. Saturated dicarboxylic acids - properties and representatives (oxalic, malonic, succinic, glutaric, adipic acids). Unsaturated dicarboxylic acids - maleic and fumaric acids. Aromatic dicarboxylic acids - phthalic, isophthalic and terephthalic acids.

27. Hydroxycarboxylic acids (fatty and aromatic) - structure and properties. Representatives - lactic acid, β-hydroxybutyric acid, tartaric, citric and salicylic acids. Drugs - derivatives of salicylic acid.

28. Aldehyde- and ketocarboxylic acids - structure and properties. More important representatives - glyoxalic, pyruvic, acetoacetic, oxaloacetic acid. Acids involved in the Krebs cycle. Ketone bodies - biological significance.

29. Carbonic acid and derivatives - uric acid, urethanes, urea, ureides, biuret, guanidine, creatine, creatine phosphate, creatinine. Biological significance.

30. Amines. Fatty and aromatic amines. Basic nature of amines (pK_b). Physical and chemical properties. Biogenic amines. Amides of medicinal importance - phenacetin and paracetamol. Biologically important amino alcohols - collamine, choline. Acetylcholine - biological role. Catecholamines - dopamine, adrenaline, noradrenaline.

31. Amino acids - classification, representatives. Essential amino acids. Chemical properties - reactions related to amine and carboxyl group. Heat relationships. Lactam-lactam tautomerism. Biological significance of amino acids.

32. Peptides - peptide bond stereochemistry. Biologically important peptides - glutathione, vasopressin, oxytocin, insulin.

33. Carbohydrates. Classification. Monosaccharides - structure, representatives (mannose, galactose, fructose, ribose and deoxyribose), stereoisomerism. Semi-acetal forms of monosaccharides. Structure of vitamin **C** and its role as an antioxidant.

34. Chemical properties of monosaccharides - oxidation reactions, reduction to polyvalent alcohols, reactions for carbonyl and hydroxyl groups. Biologically important esters. Alkylation and formation of glycosides.

35. Disaccharides. Types of binding of monosaccharide residues. Reducing and non-reducing disaccharides - structure and properties. Homopolysaccharides and heteropolysaccharides - structure and properties. Representatives.

36. Lipids - classification. Hydrolyzable lipids - structure, properties, representatives. Chemical aspects of biological oxidation of fats. Phospholipids - types and biological significance.

37. Non-hydrolyzable lipids. Terpenes and steroids. More important representatives of biological importance - carotene and retinol (vit. A). Retinal - chemical aspects of visual perception. Cholesterol and vitamin D.

38. Heterocyclic compounds - classification. Heterocyclic compounds with a pentatomic ring and one heteroatom (furan, pyrrole, thiophene). Structure and chemical properties. Biologically active substances with pyrrole structure.

39. Heterocyclic compounds with a pentatomic ring and two heteroatoms (pyrazole, imidazole and thiazole). Structure and more important chemical properties. Biologically active substances with pyrazole, imidazole and thiazole structures.

40. Heterocyclic compounds with a six-atom ring and one heteroatom (pyridine). Structure and basic chemical properties. Biologically active substances with pyridine structure.

41. Heterocyclic compounds with a six-atom ring and two heteroatoms. Pyrimidine. Barbituric acid and barbiturates. Pyrimidine bases - cytosine, uracil, thymine.

42. Bicyclic heterocyclic compounds with fused nuclei. Pteridine - structure and properties. Purine group. Structure and properties of purine. Oxygen derivatives of purine - hypoxanthine, xanthine and picric acid. Purine bases - adenine and guanine.

43. Nucleic acids (DNA and RNA) - concept. Alkaloids - general characteristics. Nicotine, atropine, cocaine, quinine and morphine. Morphine derivatives - codeine and heroin. Physiological action.

BIBLIOGRAPHY

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2. Makedonski L., Peycheva K., Panayotova, V. Chemistry Laboratory Manual, Steno, Varna, 2019
3. Makedonski L., Peycheva K., Stancheva M., Laboratory Manual for general and Organic Chemistry Students of Medicine, Steno, Varna, 2011
4. Karen C. Timberlake, Chemistry- An introduction to General, Organic and biological Chemistry, Tenth Edition, Person education, Inc. New Jesey, 2009
5. Karen C. Timberlake, Laboratory manual for General, Organic and Biological Chemistry: Structure of Life, Person Education, Inc. New Jesey, 2007
6. John McMurry, Organic Chemistry, Sixth Edition, Thomson Learning, Inc. United States, 2004
7. Benjamin Abelow, Understanding Acid-Base, Williams &Wikins, Maryland, 2007
8. Ouellette R J, Introduction to General, Organic and Biological Chemistry, Prentice-Hall 1997 and new editions
9. Bruice P.Y., Organic Chemistry, 2003, Prentice Hall PTR eight and previous editions

Students can use any other textbook in chemistry covering above topics.

Compiled by:

(Assoc. Prof. Rumyana Yankova, PhD)

(Assoc. Prof. Dr. Svetlana Zheleva, PhD)

Approved by a decision of the Council of the Department of Physiology, Pathophysiology, Chemistry and Biochemistry, Protocol № 31 / 05.11.2023г.

Head of Department .....

(Assoc. Prof. Rumyana Yankova, PhD)

Approved by a decision of the Faculty Council of the Medical Faculty, Protocol № 46 / 09.11.2023г.

Secretary of the Council of the Medical Faculty: ...

(Chief assist. Prof. Ruska Nenkova, PhD)

UNIVERSITY "PROF. DR. ASSEN ZLATAROV" – BURGAS

MEDICAL FACULTY

DEPARTMENT OF BIOLOGY, MEDICAL GENETICS, MICROBIOLOGY, MEDICAL PARASITOLOGY, CLINICAL LABORATORY AND IMMUNOLOGY

Approved by:
DEAN:
/Assoc. Prof. Rumyana Yankova, PhD/

SYLLABUS

Discipline:	**BIOLOGY**
Specialty:	**MEDICINE**
Professional field:	**7.1 Medicine**
Educational qualification degree:	**MASTER**
Form of training:	**REGULAR**

Burgas, 2023

EXTRACTS FROM THE CURRICULUM

1. GENERAL PARAMETERS OF THE DISCIPLINE			
Total (academic hours):	270	**ECTS:**	9
Auditorium classes	**Non-auditorium classes**	**Auditorium ECTS**	**Non-auditorium ECTS**
120	150	4	5
Type of Discipline	**Number of hours per week: /lectures + practicals/**	*Cours:*	*Semester:*
Mandatory	2/2 + 2/2	**I**	**I, II**

2. STUDY FORMS					
Auditorium classes:	**Academic hours**	**ECTS**	**Non-auditorium classes:**	**Academic hours**	**ECTS**
Lectures	60	2	**Consultations**	45	1.5
			Individual work		
			- preparation for colloquiums	30	1
			- preparation for seminars - discussions	15	0.5
			- preparation of protocols	30	1
Practical sessions	60	2	- preparing for the exam	30	1

3. ASSESSMENT AND CONTROL	
Forms of assessment and control	**Relative share in the total score**
Sessional evaluation: exam	0,6
Semester (ongoing) assessment:	0.4
Forms of semester control:	
- practical exam	0.4
- colloquiums	0.2
- control and tests	0.2
- defence of protocols	0.2

ANNOTATION

of the discipline "Biology"

Purpose of the course

The course "Biology" is intended for students of the specialty "Medicine", first year, full-time form of study.

Objectives

The aim of the biology course is to form:

1. The understanding that living systems, including man, have hierarchically arranged levels of organization with their own peculiarities and regularities that determine biological properties and functions.

2. The understanding that man as a product of biological evolution is ecologically related to the nature and development of the biosphere as a whole.

3. The ability to apply biological laws as a natural science theory and methodology of medicine.

4. Practical ability to work in a research and clinical setting, and theoretical knowledge of basic biological research methods with application to medicine.

Structure of the learning content

The course "Biology" provides an opportunity to acquire knowledge and skills in the following basic biological concepts:

- Molecular basis of life - biological macromolecules;
- Realization of genetic information;
- Genetic Code;
- Organization of genetic material in the cell;
- Karyotype;
- Heredity and Variability;
- Heritable Diseases in Man;
- Genetic Engineering;
- Cell Biology;
- Reproduction of Organisms;
- Individual Development;
- Immunological Homeostasis;
- Population Biology and Genetics;
- Theory of Evolution;
- Molecular Evolution;

- Relationships among organisms in biocenosis;
- Human-Nature Relationships;
- Morphology and biological cycle of the most medically important parasites.

Methods of teaching

The training is carried out through lectures and practical exercises according to the specified curriculum. Microscopes, permanent and temporary microscopic preparations, multimedia presentations, tools and technical means for illustration are used for illustration and performance of molecular biology, cell biology and immunology techniques, teaching notebooks, test books.

Forms of independent work

Participation in discussions, solving of tests, elaboration of an abstract.

Assessment methods

Formed from the average grade of the colloquia for each section, the practical examination and the grade from the combined test-examination for the semester. The final form of the grade is also influenced by any additional control questions on the extra-curricular activities, as well as participation and performance in the various forms of independent work.

Expected results

Upon completion of the biology course and successful completion of the examination, students should have the following competencies:

- In the field of theoretical knowledge - thorough theoretical knowledge of the molecular basis of life - biological macromolecules, the realization of genetic information, the nature of the genetic code and the organization of genetic material in the cell; heredity and variability, hereditary diseases in man, genetic engineering, cell biology, reproduction of organisms, individual development, immunological homeostasis, biology and genetics of populations, theory of evolution, molecular evolution, relationships between organisms in biocenosis, relationships between man and nature.
- In the field of practical skills - microscopy, preparation of non-perishable microscopic preparations, learning methods of population statistical analysis, determination of blood groups, learning methods for the demonstration of antigens and antibodies. Ability to study and recognize parasitic forms, master in vitro fertilization pattern in mammals, recognize normal human karyotype, solve medico-genetic problems.

CURRICULUM CONTENT
LECTURES

	Subject	hours
1.	Basic principles in the organization of living systems. Subject, place and significance of biology. Basic methods in biology. Development of general biology in Bulgaria.	2
2.	Molecular organization of living matter. Proteins. Functions of proteins. Composition. Structure - primary, secondary, tertiary and quaternary structure. Methods for the study and purification of proteins.	2
3.	Nucleic acids. Central dogma in molecular biology. Primary structure of DNA nucleotide. *Syn* and *anti*-conformation of the nucleotide. Relationships within and between the nucleotides. Secondary structure of DNA. Features of the double helix. Alternative forms of DNA.	2
4.	Structure of RNA. RNA types and functions.	2
5.	Cellular basis of life. Prokaryotic and eukaryotic cells - comparative structural and functional characteristics. Origin and evolution of cells. The cell - an open biological system. Intercellular communications. Cell contacts. Cell receptors. Individual development of cells. Cell aging.	2
6.	Cell reproduction. Cell growth and division. Cell cycle - interphase, mitosis. Phases and mechanism of mitosis. Nature of mitosis-promoting factor. Control of cell division in multicellular organisms.	2
7.	Molecular and cellular mechanisms of inheritance and variation. Molecular mechanisms of basic genetic processes. Replication. Basic types of replication. Transcription. RNA maturation. Genetic code. Translation. Transport of proteins in the cell organelles. Post-translational modifications.	2
8.	DNA replication. Principle of replication. Spatial organization of DNA enzymes involved in its maintenance. DNA polymerases. Other enzymes and non-enzymatic proteins required for DNA replication. Proteins providingthe single-stranded DNA matrices. Basic types of replication. DNA repair.	2
9.	Transcription. RNA polymerases. Significant and non-significant chain. Promoters in prokaryotes. Transcription in eukaryotes. Termination. RNA maturation.	2
10.	Genetic code. Translation. Transport of proteins in cell organelles. Posttranslational modifications of proteins. Aging and degradation of proteins.	2

11.	Genome organization in prokaryotic and eukaryotic cells. Regulation of gene expression. Submicroscopic structure of chromosomes. Microscopic structure of chromosomes. Karyotype.	2
12.	Regularities of hereditary phenomena. Heredity. Inheritance. Genotype and phenotype. Methods of genetic analysis - cytogenetic methods, molecular biological methods. Allelic state of genes. Interaction between genes.	2
13.	Main types of inheritance. Inheritance of linked genes. Crossingover. Groups of linked inheritance in man. Inheritance and environment. Norm of response. Phenocopy. Morphoses. Genocopy.	2
14.	Cytoplasmic inheritance. Extrachromosomal inheritance. Modification and genotypic variability. Hybrid and recombination variability. Molecular mechanisms of crossing over. Mutational variability. Types of mutations. Gene mutations and diseases. Chromosomal mutations. Genomic mutations. Cytoplasmic mutations.	2
15.	Modern diagnostic and scientific approaches. Micromanipulation of cells (cell engineering): fusion, injection into cytoplasm, experimental chimerism. Transfer of nuclei from somatic cells into oocytes (animal cloning). Recombinant DNA technologies (genetic engineering). Restrictases. Genomic cloning. DNA sequencing. Southern blot.	2
16.	Polymerase chain reaction (PCR). Reverse transcriptase. cDNA cloning and expression. Immunoblot (Western blot). Production of recombinant proteins. Transgenic bacteria, yeasts and plants. Transfection of animal cells. Transgenic animals. Gene knockout. Prospects for gene therapy.	2
17.	Innate immunity. Physiological barriers. Cellular defence mechanisms. Humoral defence mechanisms. Complement. Basic functions of complement. Inflammation. Interferons.	2
18.	Acquired immunity. Types. Structure of antibodies. Polyclonal and monoclonal antibodies. Antigen-antibody reaction. Antigens (inducers of the immune response). Haptens. Functions of antibodies. Functions of different classes of immunoglobulins. Antibody-based hypersensitivity reactions.	2
19.	Molecules of cell-mediated immunity. T-cell receptor. The master complement of tissue compatibility. Epitopes recognized by T lymphocytes. Functions of different types of T lymphocytes.	2
20.	Inductive and selective theories of antibody synthesis. Production of functional	2

immunoglobulin genes by DNA recombination. Genetic basis of T cell receptor synthesis.

21. Differentiation of lymphocytes in central lymphoid organs. Immune response in peripheral lymphoid organs. Primary and secondary immune response. Immune memory. 2

22. Regulation of the immune response. Immune tolerance. Mechanisms. Transplants. Types of transplantation and immunological basis of transplantation. Transplant reactions. Mechanisms of transplant rejection. Evolution of immunity. 2

23. ABO(H) system. Lewis system. Lectins. Biosynthesis of ABO(H) and Lewis antigens. Rhesus system. Maternal-foetal immunological conflict. 2

24. Reproduction and individual development. Reproductive biology. Sex determination and differentiation. Sexual reproduction Advantages of sexual reproduction. Cytological bases of sexual reproduction. Meiosis. Gametogenesis. Oogenesis. Molecular mechanisms of oocyte maturation. Basic characteristics of mature eggs. 2

25. Spermatogenesis. Basic characteristics of male gametes. Fertilization. Stages in the process of external fertilization. Mechanisms of blocking polyspermy. Completion of fertilization. Internal fertilization in mammals. *In vitro* fertilization and other reproductive techniques. Atypical forms of reproduction. 2

26. Developmental biology (individual development). Embryonic period. Cellular and molecular mechanisms of gastrulation. Embryonic development in mammals and man. Differentiation. Cellular differences and cellular memory in development. Postembryonic period. Old age and death. 2

27. Biological evolution. Biology and genetics of populations. Population. Phenotypic genotypic and gene frequency. Types of inbreeding. Hardy-Weinberg law. Factors modifying gene frequency. Mutations. Selection, balanced polymorphism, genetic homeostasis. Migration. Isolation. Quantitative traits. 2

28. Theory of evolution. Modern theories of evolution. Microevolution. Types of natural selection. Speciation and speciation. Modes of speciation. Directed evolution (macroevolution). Main pathways of evolution. Basic patterns of macroevolution. Molecular evolution. 2

29. Ecology and human-nature relationships - Populations, communities and ecosystems. Interactions between organisms in communities. Man and the biosphere. Biology of behaviour. 2

30.	Evolution of invertebrates with elements of medical parasitology. Parasitism as biological phenomena. Parasites and hosts. Origin of parasitism. Adaptation of the parasite to the host. Interactions between parasite and host. Ecology of parasitism.	2
	Total:	**60**

PRACTICAL SESSIONS

	Topic	**hours**
1.	Microscope - device and work with it. Microscope slides. Stereomicroscope.	2
2.	Phylum *Sarcomastigophora.* Subphyla *Mastigophora (Flagellata). Trichomonas hominis. Trichomonas vaginalis. Lamblia intestinalis (Giardia lamblia).*	2
3.	Phylum *Sarcomastigophora.* Subphyla *Mastigophora (Flagellata). Trypanosoma Rhodesiense* and *Trypanosoma gambiense (Trypanosoma brucei). Trypanosoma equiperdum. Leishmania donovani. Leishmania tropica.* Subphyla *Sarcodina. Entamoeba histolytica.*	2
4.	Phylum *Sporozoa (Apicomplexa). Plasmodium vivax. Plasmodium malariae. Plasmodium falciparum.*	2
5.	Phylum *Sporozoa (Apicomplexa). Toxoplasma gondii.* Phylum *Ciliophora,* Class *Ciliata. Balantidium coli. Paramecium caudatum.* Transition to multicellular. Phylum *Coelenterata.* Genus *Hydra.* Genus *Obelia.*	2
6.	Phylum *Platyhelminthes (Plathelminthes).* Class *Trematoda. Fasciola hepatica. Dicrocoelium lanceatum (Dicrocoelium dendriticum). Opistorchis felineus.* Genus *Schistosoma.*	2
7.	Phylum *Platyhelminthes.* Class *Cestoda. Taenia solium. Taeniarhynchus saginatus (Taenia saginata). Diphyllobothrium latum. Hymenolepis nana. Echinococcus granulosus.*	2
8.	Phylum *Nematoda. Ascaris lumbricoides. Enterobius vermicularis. Trichocephalus trichiurus. Trichinella spiralis. Strongyloides stercoralis. Ancylostoma duodenale.*	2
9.	Phylum *Nematoda. Dracunculus medinensis. Wuchereria bankrofti. Loa loa.* Phylum *Annelida. Lumbricus terrestris. Hirudo medicinalis.* Phylum *Arthropoda.* Subphyla *Crustacea.* Genus *Cyclops.* Class *Arachnoidea (Arachnida).* Order *Scorpiones.* Order *Araneae* (spiders).	2

10. Phylum *Arthropoda*. Class *Arachnoidea (Arachnida)*. Order *Acari* (ticks) – *Sarcoptes scabiei,* genus *Dermatophagoides.* 2

11. Phylum *Arthropoda*. Ticks - carriers of transmissible diseases: *Ixodes ricinus, Dermacentor marginatus, Hyalomma plumbeum, Rhipicephalus sanguineus.* Class *Insecta. Pediculus hominis. Phthirius pubis.* 2

12. Phylum *Arthropoda*. Class *Insecta. Cimex lectularius. Pulex irritans.* Genus *Culex* and genus *Anopheles. Phlebotomus papatasii.* 2

13. Role of insects in the spread of transmissible diseases. Role of insects as mechanical carriers of infectious and parasitic diseases. 2

14. Poisonous mushrooms, plants and animals. 2

15. **Colloquium on parasitology**. 2

16. DNA and chromatin. Giant chromosomes from *Chironomus larvae*. X-sex chromatin in oral mucosal cells. 2

17. Cell cycle and cell division. Mitosis, atypical forms of mitosis. 2

18. Karyotype. Normal human and animal karyotype. Evolution of the karyotype. 2

19. Xereditary phenomena. Heredity and environment. Mutational variability - gene, chromosomal and genomic mutations. 2

20. Cellular basis of sexual processes. Meiosis. Gametogenesis. 2

21. Fertilization in mammals. *In vitro* fertilization. 2

22. Individual Development. Embryonic period: segmentation, gastrulation, organogenesis. Echinoderms, fish and frog preparations. Postembryonic period: direct development, metamorphosis. 2

23. Immunogenetics. ABO (H) system. Determination of blood groups (alloagglutination). Inheritance of blood groups - construction of a family tree. 2

24. Immunological reactions. Agglutination reaction, agglutination inhibition, precipitation reaction, immunofluorescence, immunoelectrophoresis, ELISA, RIA. 2

25. Central and peripheral organs of the immune system. Cells of the immune response - lymphocytes. Preparation and evaluation of cell suspensions of lymphocytes. 2

26. Colloquium on developmental biology and immunology.	2
27. Methods of population genetics: qualitative traits. Hardy-Weinberg law. Methods of population genetics: quantitative traits.	2
28. Mutation frequency. Selection. Migration. Isolation. Genetic drift. Coefficients of relationship and inbreeding.	2
29. Mendelian inheritance. Solving genetic problems.	2
30. Colloquium.	2
Total:	**60**

EXAMINATION QUESTIONNAIRE
Biology outline

1. Subject, place and importance of biology. Basic methods in biology.
2. Nucleic acids. Central dogma in molecular biology. Primary structure of DNA nucleotide. Syn and anti conformation of nucleotide. Relationships within and between the nucleotides.
3. Nucleic acids. Secondary structure of DNA. Features of the double helix. Alternative forms of DNA.
4. Nucleic acids. Structure of RNA. RNA types and functions.
5. Comparative structural and functional characteristics of prokaryotic and eukaryotic cells. Prokaryotic and eukaryotic cells. Origin and evolution of the cell.
6. The cell - an open biological system. Intercellular signalling. Cell contacts. Cell receptors.
7. Individual cell development. Cell senescence. Elements of cellular ageing. Apoptosis and necrosis.
8. Cell reproduction. Cell cycle. Mitosis.
9. Cell reproduction. Mitosis (M-phase). Cell cycle regulation.
10. Molecular mechanisms of basic genetic processes. Principle of replication. Spatial organization of DNA and enzymes involved in its maintenance. DNA polymerases.
11. Molecular mechanisms of basic genetic processes. Other enzymes and non-enzymatic proteins required for DNA replication. proteins providing single-stranded DNA matrices. Basic types of replication.
12. Molecular mechanisms of basic genetic processes. DNA repair.
13. Molecular mechanisms of basic genetic processes. Transcription. RNA polymerases. Significant and non-significant chain. Promoters in prokaryotes. Elongation.

14. Molecular mechanisms of basic genetic processes. Transcription in eukaryotes. Termination. RNA maturation.

15. Molecular mechanisms of basic genetic processes. Genetic code. Translation.

16. Molecular mechanisms of basic genetic processes. Protein transport in cell organelles. Post-translational modifications of proteins. Aging and degradation of proteins.

17. Genome organization in prokaryotic cells.

18. Organization of the eukaryotic genome. Types of genomic DNA. DNA-binding proteins.

19. Submicroscopic and microscopic structure of chromosomes. Human karyotype. Methods of karyotyping and chromosome analysis.

20. Regularities of hereditary phenomena. Allelic state of genes.

21. Regularities of hereditary phenomena. Interaction between genes. Penetrance and expressivity.

22. Regularities of hereditary phenomena. Basic types of inheritance. Inheritance under independent combination of genes.

23. Regularities of hereditary phenomena. Inheritance of linked genes. Crossingover. Mechanisms of crossingover.

24. Heredity and environment. Norm of response. Phenocopy and genocopy. Genotypic variability. Recombinational variability.

25. Mutational variability - gene, chromosomal and genomic mutations. Mutations and diseases. Causes of mutations (mutagenic factors).

26. Innate immunity. Physiological barriers. Cellular defence mechanisms.

27. Humoral defence mechanisms. Complement.

28. Acquired immunity. Types. Structure of antibodies. Polyclonal and monoclonal antibodies. Antigen-antibody reaction.

29. Antigens (immune response inducers). Pills.

30. Functions of antibodies. Functions of the different classes of immunoglobulins.Antibody-based hypersensitivity reactions.

31. Molecules of cell-mediated immunity.T-cell receptor. The major tissue-compatibility complex. Epitopes recognized by T lymphocytes.

32. Functions of different types of T lymphocytes.

33. Theories of immunity. Genetic basis of antibodies and T cell receptors.

34. Differentiation of lymphocytes in central lymphoid organs.

35. Immune response in peripheral lymphoid organs. Primary and secondary immune response. Immune memory.

36. Regulation of the immune response. Immune tolerance. Mechanisms.

37. Transplantations. Evolution of immunity.

38. The ABO(H) system. Lewis system. Lectins. Biosynthesis of ABO(H) and Lewis antigens.

39. Rhesus system. Maternal-fetal immunological conflict.

40. Reproductive biology. Sex determination and differentiation

41. Haploid-diploid cycle. Cytological bases of sexual reproduction. Meiosis

42. Gametogenesis. Spermatogenesis. Characteristics of male gametes. Origin of sex cells.

43. Ovogenesis. Molecular mechanisms of oocyte maturation. Biological characteristics of mature oviductal antibodies. Antigen-antibody reaction.

44. Fertilization. External fertilization and mechanisms of blocking polyspermy. Completion of fertilization.

45. Fertilization. Internal fertilization in mammals. Differences between internal and external fertilization.

46. *In vitro* fertilization. *In vitro* fertilization. Atypical forms of reproduction.

47. Individual development. Embryonic period. Shaping the body plan, grey sickle, segmentation. Regulatory and mosaic type of development.

48. Formation of blastula. Gastrulation. Cellular and molecular mechanisms of gastrulation.

49. Embryonic induction. Elements of organogenesis.

50. Embryonic development in mammals and man. Differentiation, cellular differences and cellular memory.

51. Postembryonic period. Life span, old age and death.

52. Biology and genetics of populations. Population. Phenotypic, genotypic and gene frequency. Hardy - Weinberg's law.

53. Factors modifying gene frequency (violating HH's law). Isolation (gene drift). Migration. Selection.

54. Mutations. Types of interbreeding.

55. Quantitative traits - examples, Gaussian curve.

56. Theory of evolution. Species. Speciation. Pathways of speciation.

57. Directed evolution (macroevolution). Origin of supra-specific systematic groups.

58. Molecular evolution. Pre-cellular evolution. Phylogenetic relationships among organisms.

59. Human evolution. Anthropogenesis.

60. Modern diagnostic and scientific approaches. Micromanipulation of cells (cell engineering): fusion, injection into cytoplasm, experimental chimerism. Transfer of nuclei from somatic cells into oocytes (animal cloning).

61. Recombinant DNA technologies (genetic engineering). Restrictases. Genomic cloning. DNA sequencing. Sidenote.

62. Polymerase chain reaction (PCR). Reverse transcriptase. cDNA cloning and expression. Immunoblot (Western blot). Production of recombinant proteins. Transgenic bacteria, yeasts and plants.

63. Transfection of animal cells. Transgenic animals. Gene knockout. Prospects for gene therapy.

64. Characteristics of primates. Phylum *Sarcomastigophora*. Subphylum *Mastigopho* (Flagellata). *Leishmania donovani. Leishmania tropica.*

65. Phyllum *Sarcomastigophora. Lamblia intestinalis (Giardia lamblia).*

66. Phyllum *Sarcomastigophora. Trichomonas hominis. Trichomonas vaginalis.*

67. Phyllim *Sarcomastigophora. Trypanosoma rhodesiense* and *Trypanosoma gambiense. Trypa-nosoma equiperdum.*

68. Subphylum *Sarcodina. Entamoeba histolytica.*

69. Phyllum *Sporozoa* (Apicomplexa). *Plasmodium vivax. Plasmodium malariae. Plasmodium falciparum.* Malaria species

70. Phyllum *Sporozoa (Apicomplexa). Toxoplasma gondii.*

71. Phyllum *Ciliophora type.* Class *Ciliata. Balantidium coli.*

72. Transition to multicellular animals. Phyllum *Coelenterata*. Genus *Hydra*. Genus *Obelia*.

73. Phylum *Plathelminthes* (Platyhelminthes). Class *Trematoda*. *Fasciola hepatica*.

74. Class *Trematoda*. *Dicrocoelium lanceatum (Dicrocoelium dendriticum)*.

75. Class *Trematoda*. *Opistorchis felineus*. Representatives of the genus *Schistosoma*.

76. Class *Cestoda*. *Taenia solium*.

77. Class *Cestoda*. *Taeniarhynchus saginatus (Taenia saginata)*.

78. Class *Cestoda*. *Diphyllobothrium latum*. *Hymenolepis nana*.

79. Class *Cestoda*. *Echinococcus granulosus*.

80. Phyllum *Nematoda*. *Ascaris lumbricoides*.

81. Phyllum *Nematoda*. *Enterobius vermicularis*. *Trichocephalus trichiurus*.

82. Phyllum *Nematoda*. *Trichinella spiralis*.

83. Phyllum *Nematoda*. *Strongyloides stercoralis*. *Ancylostoma duodenale*.

84. Phyllum *Nematoda*. *Dracunculus medinensis*. *Wuchereria bankrofti*. *Loa loa*.

85. Phyllum *Annelida*. *Lumbricus terrestris*. *Hirudo medicinalis*. Phyllum *Arthropoda* - general haracharacteristics.

86. Phyllum *Arthropoda*. Class *Crustacea* - general characteristics. Class *Arachnoidea (Arachnida, arachnids)*. Order *Scorpiones* (scorpions) and order *Aranei* (spiders).

87. Order *Acari* (ticks) - *Sarcoptes scabiei, genus Dermatophagoides*. Ticks - vectors of transmissible diseases: *Ixodes ricinus, Dermacentor marginatus, Hyalomma plumbeum, Rhipicephalus sanguineus*.

88. Class *Insecta* (insects). *Pediculus hominis (Pediculus humanus)*. *Phthirius pubis*. *Cimex lectularius*. *Pulex irritans*. The role of insects in the spread of transmissible diseases

89. Genus *Culex* and genus *Anopheles* - morphological differences. *Phlebotomus papatasii*.

90. Role of insects in the spread of transmissible diseases. Role of insects as mechanical vectors of infectious and parasitic diseases. Poisonous fungi, plants and animals.

RECOMMENDED LITERATURE

1. **Bios instant notes. Molecular Biology** by A. McLennan, A. Bates, P. Turner, M. White. 2013; 4th edition; Garland Science, Taylor & Francis Group, LLC; ISBN978-0-415-68416-3
2. **Practical Book. Medical Biology for first year students** by Sarafian V., M. Kazakova, M. Draganova, N. Mehterov. 3rd edition. 2020. Medical University Plovdiv ISBN; 978-619-237-016-9
3. **Bios instant notes. Immunology** by P. Lydyard, A. Whelan, M. Fanger. 2008; 8th edition; Garland Science, Taylor & Francis Group, LLC; ISBN 978-0-4156-0753
4. **Basic Immunology: Functions and Disorders of the Immune System** by Abul K. Abbas, Andrew H. Lichtman, Shiv Pellai . 2014; 4th edition; ISBN-13: 978-1455707072; ISBN-10: 1455707074
5. **Paniker's Textbook of Medical Parasitology** by C.K. Jayaram Paniker. 2013; 7th edition; ISBN-10: 9350905345; ISBN-13: 978-9350905340
6. **Parasitology. Manual for first year students in medicine and dental medicine** by Alexandrov V., Feodorova Y., Filipova M., Kazakova M., Mehterov N., Sarafian V., 2016, Plovdiv.

Additional

1. Human Biology by Starr C. and McMillan B. 2014; 10th edition; Yolanda Cossio; ISBN-13 978:1-133-59916-6

Compiled by: ...

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(Assoc. Prof. Dr V. Merhar, PhD)

Approved by a decision of the Council of the Department of Biology, Medical genetics, Microbiology, Medical parasitology, Clinical laboratory and Immunology, protocol No. 19/06.11.2023 г.

Head of the Department:

(Assoc. Prof. Dr V. Merhar, PhD)

Approved by a decision of the Faculty Council of the Medical Faculty, Protocol №.46/09.11.2023г.

Secretary of the Council of the Medical Faculty: .....

(Chief Assist. Prof. Ruska Nenkova, PhD)

UNIVERSITY "PROF. DR. ASEN ZLATAROV" - BURGAS

MEDICAL FACULTY

DEPARTMENT OF ANATOMY, HISTOLOGY, EMBRYOLOGY, PATHOLOGY, LATIN LANGUAGE, FORENCIC MEDICINE, DEONTOLOGY

Approved by!
DEAN:
/Assoc. Prof. Rumyana Yankova, PhD/

SYLLABUS

Discipline:	**LATIN LANGUAGE AND MEDICAL TERMINOLOGY**
Specialty:	**MEDICINE**
Professional field:	**7.1. Medicine**
Educational and qualification degree:	**MASTER**
Form of training:	**REGULAR**

Burgas, 2023

EXTRACTS FROM THE CURRICULUM

1. GENERAL PARAMETERS OF THE DISCIPLINE			
Total (academic hours):	150	**ECTS:**	5

Auditorium classes	**Non-auditorium classes**	**Auditorium ECTS**	**Non-auditorium ECTS**
60	90	2	3

Type of Discipline:	**Academic hours per week: /lectures + practices/**	*Course:*	*Semester:*
Mandatory	2	**I**	**I+II**

2. STUDY FORMS					
Auditorium classes:	**Academic hours**	**ECTS**	**Non-auditorium classes:**	**Academic hours**	**ECTS**
Practices	60	2	**Consultation**	15	0.5
			Individual work	75	2.5

3.EVALUATION AND CONTROL	
Forms of evaluation and control	**Relative share in the total score**
Sessional evaluation: exam	**0.4**
Semester (ongoing) assessment:	**0.6**
Forms of semester control:	
- Attendance at classes	0.1
- Active participation in classes	0.2
- Continuous assessment in class	0.7

ANNOTATION

Each professional community needs a specialized language for the terminology used at the scientific level. For those, working in the field of medicine, that language is Latin per se, also acting as a mediator of Greek – basic for clinical practice, therapy and pathology. Study of Latin and medical terminology during the first year of medical education is sine qua non for every level of training and for the practice of every physician. The philosophy of medical science as a whole and of all its subspecialties is coded in Latin. Teaching Latin for specialized training in the first year of medical training is the necessary prerequisite for the better acquisition of other disciplines that are part of the syllabus for each specialty studied at Medical University of Plovdiv in the course until completion of studies. According to tradition and methodology accepted and used in Bulgaria, all the diagnoses included in the textbooks and the additional sources for information and practice for the different subjects are written in Latin. That is the reason why the Latin course is of general educational nature, but it is also a supportive discipline for the understanding and 4 utilization of medical concepts in anatomy and clinical practice. In the first year the Latin course meets the immediate needs of students regarding the course in anatomy, while giving them sufficient grammar knowledge and presenting the principles of word formation to meet the long-term needs in the upper courses of study and the medical field of future specialization.

BASIC AIMS

The syllabus offered aims to teach the students the grammatical and lexical minimum necessary for the proper understanding, reading and writing of diagnoses; the principles of word formation; Greek combining forms and their Latin equivalents. Study contents according to the aims: I st semester: basic Latin grammar aimed at the medical profession: nouns and adjectives – morphological features; agreed and non-agreed attributes; study of a minimum quantity of terms necessary to understand subjects taught in the first course; reading and writing of diagnoses with elementary phraseological structure and syntax; basic information on prescription writing. IInd semester: Greek declensions in Latin; compound terms word-formations – Greek and Latin terminological elements, prepositions and prepositions as prefixes in word formation; comparatives and superlatives of the adjectives; clinical and pathoanatomical diagnoses.

EXPECTED RESULTS

It is expected that by the end of the Latin course the students are going to be able to use the grammatical and lexical minimum that forms the basic microlanguage in the field of medicine as a science. The course gives the information about the medical terminology as a part of the general human knowledge achieved in its diachronic development. When the Latin course is completed students should be able to: - use the lexical minimum that serves the needs of other disciplines; - use the minimum of grammar necessary for diagnoses understanding; - use the acquired grammatical minimum for writing diagnoses in Latin with familiar and unfamiliar vocabulary; - know the principles of compound terms word-formation used in clinical practice, for different types of treatment and kinds of pathology; - know how to understand the compound clinical and pathological terms; - be able to produce compound terms by their own.

EVALUATION CRITERIA:

- complex annual final written exam aiming to control the achieved self-training skills while using in practice the acquired knowledge during the course - 40%;
continuous assessment and term tests - 60%.

Continuous assessment – complex assessment of knowledge and skills with the following components.

Theses to seminars

Seminar № 1 – 2 hours Alphabet and pronunciation History and development of the Latin language. Alphabet. Classification of sounds: vowels, consonants, diphthongs, digraphs. Pronunciation of vowels, consonants, diphthongs, digraphs. Accentuation Quantity and syllabification Rules of accentuation

Seminar № 2 – 2 hours Nouns and adjectives – general information Grammatical categories of nouns and adjectives: gender, number, case. Declensions of nouns. First declension. Vocabulary forms of nouns. Defining the practical stem. Case endings. First Greek declension. Syntax structure of a phrase. Initial information on the use of prepositions. 9

Seminar № 3 – 2 hours Word-formation in medical terminology Defining term components: prefix, root, suffix. Greek combining term-elements corresponding to nouns of the first Latin declension. Decoding clinical and pathoanatomical terms. Coining terms.

Seminar № 4 – 2 hours Second Latin declension. Second Greek declension.

Seminar № 5 – 2 hours Word-formation in medical terminology Greek combining term-elements corresponding to nouns of the second Latin declension

Seminar № 6 –. Decoding clinical and pathoanatomical terms. Coining terms 2 hours Adjectives of the first and second declension. Past participle. Agreed and non-agreed attributes. Suffixes in the formation of adjectives. Meaning of suffixes. Agreement of adjectives and nouns. Word-formation. Greek term-elements corresponding to adjectives of first and second declension.

Seminar № 7 – 2 hours Drills on first and second declension – nouns and adjectives and Greek term-elements corresponding to nouns and adjectives of first and second declension.

Seminar № 8 – 2 hours Written examination (nouns and adjectives of first and second declension and their corresponding Greek term-elements)

Seminar № 9 – 2 hours Thrid declesion Third declension – consonant stems Characteristic features. Characteristic endings for nominative

Seminar № 10 – 2 hours Terms of Greek origin (Third Greek declension). Locative Adjectives with the -ior/-ius-suffix. Combining term-elements corresponding to third consonant declension Latin nouns.

Seminar № 11 – 2 hours Drills on third declension consonant stems

Seminar № 12 – 2 hours Third vocal declension – i-stems Feminine nouns (Latin and Greek). Neuter nouns

Seminar № 13 – 2 hours Terms of Greek origin (Third Greek declension). Combining term-elements corresponding to third vocal declension Latin nouns. Decoding clinical and pathoanatomical terms. Coining terms

Seminar № 14 – 2 hours Third declension – mixed stems. Word-formationParisyllabic names – how to differentiate them from third vocal declension nouns. Imparisyllabic names - how to differentiate them from third consonant declension nouns.

Seminar № 15 – 2 hours Greek term-elements corresponding to third mixed stem declension Latin nouns. Decoding clinical and pathoanatomical terms. Coining terms.

Seminar № 16 – 2 hours Revision of first and second declension – nouns and adjectives. General rules. Revisional drills.

Seminar № 17 – 2 hours Adjectives of the third declension. Adjectives of three nominative endings for the three genders. Adjectives of two nominative endings for the three genders. Adjectives of one nominative ending for the three genders.

Seminar № 18 – 2 hours Present Participle – formation and usage

Seminar № 19 – 2 hours Comparative and superlative forms of the adjectives – usage. Comparative degree of adjectives. Superlative degree of adjectives. Comparatives in anatomy
Seminar № 20 – 2 hours Revision of third declension – nouns (consonant, vocal, and mixed stems) and adjectives. General rules. Revisional drills.
Seminar № 21 – 2 hours 11 Greek declensions in Latin –revisional notes. Frist Greek declension Second Greek declension Third Greek declenison
Seminar № 22 – 2 hours Written examination (first, second, third declension – nouns and adjectives and their corresponding Greek term-elements)
Seminar № 23 – 2 hours Fourth declension. Word formation Masculine nouns. Neuter nouns.
Seminar № 24 – 2 hours Greek combining forms, corresponding to nouns of the fourth declension Decoding clinical and pathoanatomical terms. Coining terms and using them in diagnoses.
Seminar № 25 – 2 hours Fifth declension Agreed attributes and attributive genitive in the description of caries.
Seminar № 26 – 2 hours Combining term-elements corresponding to fifth declension Decoding clinical and pathoanatomical terms. Coining terms and using them in diagnoses.
Seminar № 27 – 2 hours Prepositions with Accusative and Ablative case. Latin declensions – revision. Prepositions in diagnoses and prescriptions.
Seminar № 28 – 2 hours Greek and Latin prepositions used as prefixes in the formation of medical terms. Latin prepositions used as prefixes in the formation of medical terms. Greek prepositions used as prefixes in the formation of medical terms
Seminar № 29 – 2 hours Revision of combining forms Classification of combining forms: combining forms for parts of the body Combining forms for therapeutic, diagnostic and surgical procedures Combining forms for colors and body liquids
Seminar № 30 – 2 hours Preparation for the final exam

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3. Lingua Latina Medicinalis, V. Nikolova, I. Koleva, Sofia 2002
4. Nova Terminologia Medica Polyglotta et Eponymica, P. Arnaudova, G. Arnaudov, Sofia 2003
5. Latinum: https://www.facebook.com/pages/LATINUM/357963236498
6. J. B. Greenough, G. L. Kittredge, A. A. Howard, Benj. L. D'Ooge, Ed. Allen and Greenough's New Latin Grammar for Schools and Colleges, online edition: http://www.perseus.tufts.edu/hopper/text?doc=Perseus
7. Medical Terminology activities: http://msjensen.cehd.umn.edu/1135/med_term_activites/default.html
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Compiled by: ,

(Stoyanka Nikolova)

Approved by a decision of the Council of the Department of Anatomy, Histology,

Embryology, Pathology, Forensic Medicine and Ethics, Protocol №25/08.11.2023г.

Head of Department:.....
(Prof. Minko Minkov, MD, PhD)

Approved by a decision of the Council of the Faculty of Medicine, Protocol № 46/09.11.2023г.

Secretary of the Council of the Faculty of Medicine: .....
(Chief Assis. Prof. Ruska Nenkova, PhD)

UNIVERSITY "PROF. DR. ASEN ZLATAROV" – BURGAS

MEDICAL FACULTY

DEPARTMENT OF ANATOMY, HISTOLOGY, EMBRYOLOGY, PATHOLOGY, FORENSIC MEDICINE AND ETHICS

Approved by:

DEAN

/Assoc. Prof. Rumyana Yankova, PhD/ /

SYLLABUS

Discipline:	**HUMAN ANATOMY AND HISTOLOGY**
Specialty:	**MEDICINE**
Professional field:	**7.1. Medicine**
Educational and qualification degree:	**MASTER**
Form of training:	**REGULAR**

Burgas, 2023

EXTRACTS FROM THE CURRICULUM

1. GENERAL PARAMETERS OF THE DISCIPLINE			
Total (academic hours):	720	**ECTS:**	24
Auditorium classes	**Non-auditorium classes**	**Auditorium ECTS**	**Non-auditorium ECTS**
315	**405**	**10.5**	**13.5**
Type of Discipline:	**Academic hours per week: /lectures + practices/**	*Course:*	*Semester:*
Mandatory	**1/2/2/2 + 2/4/4/4**	**I + II**	**I, II, III, IV**

2. STUDY FORMS					
Auditorium classes:	**Academic hours**	**ECTS**	**Non-auditorium classes:**	**Academic hours**	**ECTS**
Lectures	105	3.5	**Consultation**	105	3.5
Practices	210	7	**Individual work**	300	10

3.EVALUATION AND CONTROL	
Forms of evaluation and control	**Relative share in the total score**
Sessional evaluation: exam	**0.4**
Semester (ongoing) assessment:	**0.6**
Forms of semester control: Colloquiums	
- Osteology	**0.15**
- Arthrology	**0.15**
-Splanchnology (macro and micro)	**0.2**
- Dissections (head, neck, back, thorax)	**0.15**
- Dissections (upper and lower limbs)	**0.15**
- Central nervous system - (macro and micro)	**0.2**

ANOTATION

For the mandatory course "Anatomy and Histology"

Human Anatomy is a morphological discipline studying the structure of the human body. A number of anatomical disciplines have formed within general anatomy. The main ones are Systematic and Topographic Anatomy.

Systematic anatomy studies the structure of the human body by systems and organs at different levels of organization - macroscopic, light microscopic and electron microscopic. In this way, special histology is integrated as the equivalent of microscopic anatomy. This way of studying provides the best opportunities to understand the arrangement of systems and organs, as a basis for studying physiology, pathology and clinic.

Topographic Anatomy is a natural cantinuation of the teaching of systematic anatomy. It studies the human body by regions on a dissection principle. Dissection of the human body, preserved in a special way, is the main anatomical method that is widely used in studying its structure. It creates conditions for direct acquisition of anatomical knowledge during layer-by-layer preparation of skin, subcutaneous tissue, fascia, muscles, blood vessels, nerves, organs and systems, according to the needs of clinical medicine. The teaching of Topographic Anatomy is a continuous process that begins with second-year students, continues with the training of the future physicias in the stages of their postgraduate qualification and in conducting clinical research, medical manipulations, operative interventions, applying new methods of transplantation and anesthesia.

Goals

The main goal of the discipline is to acquire in-depth knowledge of the normal structure of of the human body's organs and systems. This is a mandatory prerequisite for studying the pathological processes in various diseases.

Main tasks of the curriculum

- ✓ Study of the macroscopic structure of organs and systems in the human body.
- ✓ Study of the microscopic structure of organs in the human body..
- ✓ Study of embryonic development of organs and systems in the human body.
- ✓ Study of Topographic and X-ray anatomy of organs and tissues in the human body.

Expected results

Acquiring comprehensive knowledge of the macroscopic and microscopic structure, systematic, topographic and X-ray Anatomy of organs and systems in the human organism.

Determining the location of bony and other landmarks of the body, the skeletotopy and syntopy of the various organs, determining the innervation areas of the surface of the head, neck, torso and limbs, the projections of the main vessels and nerves, the location of the subcutaneous venous vessels, recognizing the histological (macroscopic) structure of the organs and ability for differential histological diagnosis of the same.

Mastering the dissection techniques of preserved cadaver material using scalpel and forceps.

Current control and final exam on students' knowledge of Anatomy and Histology.

Current control is carried out through colloquiums on the individual sections of the discipline.

I. ***Colloquiums:***

1. Osteology
2. Arthrology
3. Splanchnology - combined (macro- and micro)
4. Dissection course: back, head, neck, chest, abdomen and pelvis
5. Dissection course: limbs
6. CNS and sensory organs - combined (macro and micro)

The final exam takes place during the summer session of the 2nd year (after the fourth semester), and consists of the following parts:

✓ practical exam in anatomy on 10 questions from each section (bones, joints, upper limb, lower limb, internal organs, head, trunk, brain and spinal cord and sensory organs) and in histology on 6 histological preparations

✓ theory exam with combinations including 6 questions, on one of the following sections:

- bones, joints and muscles
- internal bodies (in written form)
- сърдечно-съдова и лимфна система, кръвотворни органи
- central nervous system and sensory organs (in written form)
- peripheral nervous system (in written form)
- topographic anatomy

CONTENT OF THE CURRICULUM PROGRAM

	ANATOMY AND HISTOLOGY	
	1. INTRODUCTION TO ANATOMY, HISTOLOGY AND EMBRYOLOGY	
	LECTURE COURSE - 4 HOURS	
№	Topic of the lecture	Hours
	1st semester	
1.	Introduction to Anatomy, Histology and Embryology. Subject, purpose, tasks, relations with other biological sciences and the place of anatomy in medical education. Anatomical terminology (nomenclature). Levels of construction of the human organism. Orientation in the human body.	2
2.	Methods of study of the human body structures in norm at the different levels of organization.	2
	2-4. OSTEOLOGIA. ARTHROLOGIA. IMAGING ANATOMY. MYOLOGIA.	
	LECTURE COURSE - 11 HOURS	
№	Topic of the lecture	Hours
	1st semester	
1.	Musculoskeletal system - definition and parts. Osteology. Shape, internal structure and classification of the bones. The bone as an organ.	3
2.	Study of connections between bones - Arthrology. Joints. Biomechanics of joints.	2
3.	An introduction to Imaging Anatomy and its relevance to clinical disciplines. X-ray Anatomy, Echography, Computed Tomography, Gamma chamber Scintigraphy, Magnetic Resonance.	3
4.	Myology. Shape of muscles. The muscle as an organ - organization, additional structures and mechanics of the muscles.	3
	2. OSTEOLOGIA	
	PRACTICAL EXERCISES (SEMINARS) - 18 hours	
№	**Topics**	Hours
	1st semester	
1.	Anatomical terminology. The human skeleton. Tissues and organs of the skeletal system. Functions of skeleton.	1

2.	Axial skeleton: vertebral column, ribs and sternum (thoracic cage).	2
3.	Skeleton of the upper limb: bones of the pectoral girdle and bones of the upper limb.	2
4.	Pelvic girdle - os coxae.	2
5.	Skeleton of the lower limb	2
6.	Skull (skeleton of the head) - general features. Cranial bones - Cranium cerebrale (Neurocranium): occipital bone, sphenoid bone, parietal bone, frontal bone, temporal bone and ethmoid bone.	4
7.	Cranium faciale (Viscerocranium).	2
8.	The skull as a whole - cranial calvaria (skull cap) and cranial base (external and internal surface of the base). Anterior view of the skull (norma facialis). Orbit. Bony nasal cavity. Lateral view of the skull (norma lateralis). The temporal fossa, the intratemporal fossa, the pterygopalatine fossa.	2
9.	**Colloquium in Osteology.**	1
	ARTHROLOGIA. X-RAY ANATOMY OF THE BONE-JOINT APPARATUS	
	PRACTICAL EXERCISES (SEMINARS) - 12 HOURS	
№	**Topics**	Hours
	1st semester	
1.	Basic information about the joints.	1
2.	Joints, mechanics and X-ray Anatomy of the spine. Joints of the ribs to the vertebral column and sternum. Chest as a whole. Mechanics and X-ray Anatomy of the thorax. Joints of the vertebral column to the skull.	2
3.	Joints of the pectoral girdle and joints of the upper limb. Mechanics and X-ray anatomy of the pectoral girdle and the upper limb.	2
4.	Joints of the pelvic girdle. The pelvis as a whole. X-ray anatomy of the pelvis.	2
5.	Joints of the lower limb and mechanics of the lower limb. The foot as a whole. X-ray Anatomy of the lower limb.	2
6.	Joints of the skull bones. Temporomandibular joint. Age pecularities and X-ray Anatomy of the skull.	2
7.	**COLLOQUIUM IN ARTHROLOGV AND X-RAY ANATOMY OF THE BONE-JOINT APPARATUS.**	1
	4. MYOLOGIA	
	The study of muscles is included in dissection courses with Topographic Anatomy of the back, head, neck, chest, abdomen, pelvis, upper and lower extremities.	
	5. SPLANCHNOLOGIA	
	LECTURE COURSE - 24 HOURS	
№	**Topics**	Hours
	II-nd semester	
1.	General principles of structure of the internal organs.	1
2.	Digestive system. Morphology. Ontogenesis. Oral cavity. Ontogenesis and malphormations of the face and oral cavity.	1
3.	Teeth. Tongue. Salivary glands.	2
4	Pharynx. Esophagus. Stomach.	2
5.	Small intestine. Large intestine.	2
6.	Liver.	1
7.	Galbadder and bile ducts. Pancreas.	1
8.	Peritoneum	1
9.	General principles of construction of the respiratory system. Ontogenesis. Nose: external nose and nasal cavity.	1
10.	Larynx. Trachea. Primary bronchi.	1
11.	Lungs. Pleura.	2

12.	Urinary system.	2
13.	Reproductive systems. Development of the urinary and reproductive system.	1
14.	Female reproductive system.	2
15.	Male reproductive system.	2
16.	Endocrine system - general data. Pituitary gland. Hypothalamic-pituitary system. Epiphysis.	1
17.	Thyroid gland. Parathyroid glands. Adrenal gland. Gastroenteropancreatic endocrine system.	1
	5. SPLANCHNOLOGIA	
	PRACTICAL EXERCISES - 52 HOURS	
№	Topic	hours
	Macroscopic anatomy	**26**
	II-nd semester	
1.	Internal organs. General plan of structure of the hollow and parenchymal organs.	2
2.	Digestive system. Oral cavity: parts, walls and organs in it.	2
3.	Major salivary glands: parotid, submandibular and sublingual glands. Pharynx.	2
4.	Esophagus. Stomach.	2
5.	Small intestine. Large intestine.	2
6.	Liver. Pancreas.	2
7.	Respiratory system. Nose. Larynx. Trachea. Primary bronchi.	2
8.	Lung.	2
9.	Urinary system. Kidney. Excretory tracts (small calyces, large calyces, renal pelvis; ureter). Urinary bladder.	3
10.	Male reproductive system. Testis. Epididymis. Ductus deferens. Seminal vesicle. Prostate. Bulbourethral gland. Penis. Male urethra.	3
11.	Female reproductive system. Ovary. Fallopian tube. Uterus. Vagina. External female genitalia.	2
12.	**Colloquium**	2
	Microscopic Anatomy (Histology)	**26**
	II-nd semester	
1.	Digestive system. Lip. Tooth. Tongue. Palatine tonsil.	2
2.	Major salivary glands: parotid, submandibular and sublingual glands. Pharynx (incl. Pharyngeal tonsil).	2
3.	Esophagus. Stomach.	2
4.	Small intestine - duodenum, mesenteric small intestine. Large intestine (incl. appendix).	2
5.	Liver. Gallbladder. Pancreas.	2
6.	Respiratory system. Nasal mucosa (respiratory part). Larynx. Trachea.	2
7.	Lung.	2
8.	Urinary system. Kidney. Ureter. Urinary bladder.	2
9.	Male reproductive system. Testis. Epididymis. Ductus deferens. Seminal vesicle. Prostate gland. Corpus spongiosum of the penis.	2
10.	Female reproductive system. Ovary. Fallopian tube. Uterus. Vagina.	2
11.	Endocrine system: pituitary gland and pineal gland.	2
12.	Endocrine system: thyroid gland, parathyroid glands, adrenal glands.	2
13.	**Colloquium**	2
	6. ANGIOLOGIA	
	LECTURE COURSE - 12 HOURS	
№	Topics	hours
	II-nd semester	

1.	Vascular (circulatory) system. General data. Organizational plan of the circulatory system. Anastomoses. Collateral circulation. Ontogenesis of the circulatory system.	2
2.	Heart. External relief, cavities, flaps. Structure of the heart wall. Blood supply and innervation of the heart. Pericardium. Topographic anatomy of the heart. Ontogenesis.	2
3.	Vascular wall: arteries, veins, microcirculatory vascular bed.	2
	III-rd semester	
1.	Major arterial and venous vessels. Small and large circle of blood circulation - an overview.	2
2.	Lymphatic system - overview and structural plan. Lymph vessels. Lymphatic organs: principle structure. Lymphatic follicles.	2
3.	Lymph nodes. Palatine tonsil. Lien. Thymus. Spinal cord.	2
	6. ANGIOLOGIA	
	PRACTICAL EXERCISES - 12 HOURS	
№	Topics	Hours
	Macroscopic anatomy	**4**
	II-nd semester	
1.	Vascular (circulatory) system. Heart. Pericardium.	2
2.	Blood vessels: arteries, microcirculatory vascular bed, veins. Arterio-venous anastomoses. Lymph vessels.	2
	Microscopic Anatomy (Histology)	**4**
	II-nd semester	
1.	Vascular system. Heart. Pericardium.	2
2.	Arteries. Microcirculatory vascular bed. Veins.	2
	IV-th semester	
1.	Hematopoietic and lymphopoietic organs: central ones - red bone marrow, thymus; peripheral ones - lymph node, spleen. Mucosa-associated lymphoid tissue.	2
	7. SYSTEMA NERVOSUM CENTRALE / CENTRAL NERVOUS SYSTEM	
	LECTURE COURSE – 28 hours	
№	Topic	Hours
	III-rd semester	
1.	Nervous system: general data and principles of organization of the nervous system. Ontogenetic development of the nervous system. Central nervous system - general data.	1
2.	Spinal cord: macroscopic structure and cytoarchitectonics.	2
3.	Spinal cord: composition of spinal cord white matter funiculi, formation of the spinal nerves. Meninges and blood supply of the spinal cord.	2
4.	Brain: general features, parts. Formation of the cranial nerves.	1
5.	Brainstem - medulla oblongata, pons.	2
	IV-th semester	
6.	Brainstem - Mesencephalon (midbrain). Reticular formation.	2
7.	Cerebellum. Fourth ventricle	2
8.	Diencephalon. Third ventricle.	2
9.	Telencephalon: basal nuclei, mantle, Rhinencephalon, structures of the limbic system. Lateral ventricles.	2
10.	Telencephalon`s cortex: cytoarchitectonics and myeloarchitectonics; localization of functions in the cortex; functional asymmetry of the cortex.	2
11.	Cerebral meninges and blood supply. Blood-brain barrier. Liquor Circulation. Blood-liquor barrier.	2
12.	Functional systems in central nervous system - general features and classification. General sensory systems. Specific sensory systems.	2
13.	Motor systems: pyramidal system and extrapyramidal system. Nervous-endocrine system. Central transmitter systems.	2

14.	Limbic system - functional characteristics.	2
15.	General principles of structure of the autonomic (vegetative) nervous system. Vegetative innervation of internal organs.	2
	7. SYSTEMA NERVOSUM CENTRALE	
	EXERCISES - 28 hours	
№	Topic	Hours
	Macroscopic Anatomy (Dissection Course)	**24**
	IV-th semester	
1.	Meninges and their formations. Blood supply to the brain. Parts of the brain. Places of emergence of the cranial nerves (CN) at the brain base. Internal surface of the cranial base - places for the passage of the CN through it.	2
2.	Telencephalon: cerebral hemispheres. External relief of the hemispheres - lobes, sulci, gyri. Insula.	2
3.	Basal nuclei of the hindbrain. White matter of the hindbrain. Lateral ventricules.	2
4.	Olfactory brain (Rhinencephalon). Limbic system.	2
5.	Diencephalon. Third ventricle. Reticular formation.	2
6.	Mesencephalon (midbrain).	2
7.	Pons. Medulla oblongata.	2
8.	Cerebellum. Fourth ventricle	2
9.	Spinal cord. External and internal structure. Cytoarchitectonics. Composition of the white matter bundles of the spinal cord. Formation of spinal nerves.	2
10.	Functional systems in the CNS. Motor systems: pyramidal motor system, oculomotor system, extrapyramidal system.	2
11.	Functional systems in the CNS. Sensory systems.	2
12.	**Colloquium in CNS.**	2
	Microscopic Anatomy (Histology)	**4**
	IV-th semester	
1.	Spinal cord. Spinal and autonomic ganglion. Nerve. Brainstem.	2
2.	Cerebellum. Telencephalon.	2
	8. ORGANA SENSUUM / SENSORY ORGANS	
	LECTURE COURSE - 6 hours	
№	Topic	Hours
	IV-th semester	
1.	Sensory organs - general data. Organ of vision.	2
2.	Organ of hearing and balance	2
3.	Gustatory organ. Olfactory organ.	1
4.	Skin and skin appendages.	1
	8. ORGANA SENSUUM	
	PRACTICAL EXERCISES - 10 hours	
№	Topic	Hours
	Microscopic Anatomy (Histology)	**10**
	IVth semester	
1.	Organ of vision. Eyeball.	2
2.	Eyelid. Lacrimal gland. Organ of hearing and balance. Inner ear - bony and membranous cochlea.	2
3.	Gustatory organ. Olfactory organ.	2
4.	Skin and skin appendages. Hairless (thick) skin. Hairy (thin) skin. Nail.	2
5.	Mammary gland - non-lactating and lactating.	1
6.	**Colloquium**	1

	9. DISSECTION COURSE WITH TOPOGRAPHIC ANATOMY - BACK, HEAD, NECK, THORAX, ABDOMEN, PELVIS	
	LECTURE COURSE - 4 HOURS	
№	Topic	Hours
	III-rd semester	
1.	Topographic anatomy: subject and tasks. Clinical Anatomy (Applied Anatomy).	1
2.	Topographic anatomy of the back	2
3.	Topographic anatomy of the head.	3
4.	Topographic anatomy of the neck	2
5.	Topographic anatomy of the thorax.	3
6.	Topographic anatomy of abdomen	4
7.	Topographic anatomy of the pelvis	1
	9. A. DISSECTION COURSE WITH TOPOGRAPHIC ANATOMY - BACK, HEAD, NECK, THORAX, ABDOMEN, PELVIS	
	PRACTICAL EXERCISES - 60 hours	
№	Topic	Hours
	III-rd semester	
	I. Dissection of the back	
1.	General instructions for dissection course on cadaver. Topographic and anatomical peculiarities of the back- regions. Shape and surface anatomy of the back. Skin incisions. Skin removal. Cutaneous nerves of the back. Posterior region of the neck (regio colli posterior) - superficial layer (cutaneous nerves, occipital artery). Superficial muscles of the back. **Subject for discussion:** Dorsal rami (branches) of spinal nerves (nn. spinales - rami dorsales).	2
2.	Nerves and blood vessels of the superficial muscles of the back. Deep back muscles of ventral and dorsal embryonic origin. **Subject for discussion**: Muscles of the back. Fasciae.	2
3.	Posterior region of the neck (regio colli posterior) - deep layer. Suboccipital triangle (trigonum suboccipitale). Vertebral region (regio vertebralis). Lumbar region (regio lumbalis). Articulations and ligaments of the spinal column. **Subject for discussion: Nerves and blood vessels of the back.**	2
4.	Opening of the vertebral canal - laminectomy. **Subject for discussion**: Vertebral canal, spinal cord - general data, external morphology; meninges and blood supply of the spinal cord. Spinal ganglions. Formation of the spinal nerves.	4
	II. Dissection of the head, neck, thorax, abdomen and pelvis.	
5.	Turning the corpse. Topographic regions of the head, neck, thorax and abdomen. Palpable bony landmarks and surface anatomy. Skin incisions. Skin removal. Cutaneous nerves of the thorax and abdomen. **Subject for discussion**: Veins of the head and neck. Ventral rami of the spinal nerves. Cervical plexus (plexus cervicalis). Anterior rami of the thoracic nerves (nn. intercostales).	2
6.	Lateral region of the face (regio faciei lateralis) - superficial layer, superficial veins, facial nerve, muscles of the facial expression, branches of facial nerve for muscles of the face. Subcutaneous objects of the neck: superficial veins, subcutaneous muscle of the neck – platysma, cutaneous nerves of cervical plexus. Superficial layer - superficial veins and nerves. Infraclavicular region (regio infraclavicularis). Regio mammalis - fascia, muscles. Anterior abdominal wall - subcutaneous layer; inguinal region - superficial veins and nerves. Reflection of the external oblique muscle (m. obliquus abdominis externus). Inguinal canal. **Subject for discussion**: Veins o of the head and neck. Facial nerve (CN VII). Cervical fascia. Superficial veins of the thoracic wall and superior part of the anterior abdominal wall.	2

7.	Regio parotideomasseterica - superficial layer. Temporal region - superficial layer, blood vessels and nerves, temporal fascia. Cervical fascia - superficial layer (lamina superficialis). Regio sternocleidomastoidea - presenting of sternocleidomastoid and suprahyoid muscles. Submandibular triangle. Regio infraclavicularis - muscles, triangles, blood vessels, nerves. Axillary region (regio axillaries). Pectoral muscles. Reflection of the internal oblique muscle (musculus obliquus abdominis internus) and demonstration of the transverse abdominal muscle. **Subject for discussion:** Subclavian artery and axillary artery. Brachial plexus - formation, nerves for the pectoral girdle.	2
8.	Mastoid region (regio mastoidea). Carotid triangle. Infrahyoid muscles. Reflecting of the sternocleidomastoid muscle. Hypoglossal nerve. Thoracic wall. Internal thoracic artery. Axillary region - nerves of the upper limb. Rectus abdominis muscle - sheath. Inguinal canal. **Subject for discussion**: Spermatic cord (funiculus spermaticus). Hypoglossal nerve (CN XII).	2
9.	Orbital region (regio orbitalis) - superficial (palpebral) section. Muscles around palpebral fissure. Zygomatic region (regio zygomatica). Infraorbital region (regio infraorbitalis). Reflection of sternocleidomastoid muscle. Superficial muscle layer of the neck. Carotid triangle. Common carotid artery. Internal and external carotid arteries. Complete dissection of the axillary region (regio axillaries). Axillary artery, lymph nodes. Reflection of the rectus abdominis muscle. Openinig of the abdominal cavity. Anterior abdominal wall - posterior surface. **Subject for discussion**: Common carotid artery. Internal and external carotid arteries - branches.	4
10.	**SEMINAR:** Abdominal cavity - parts. Peritoneum. Skeletotopy, holotopy and syntopy of the abdominal organs.	2
11.	Regio buccalis. Regio mentalis. Lateral region of the neck (trigonum colli laterale) - superficial objects. Neurovascular bundle of the neck. Cervical veins. Accessory nerve. Vagus nerve. Cervical part of thoracic duct. Opening of the thoracic cavity. Anterior mediastinum. Superior mediastinum - retrosternal objects. Inferior part of the abdominal cavity - peritoneal spaces and formations. Abdominal aorta - unpaired branches. Superior mesenteric artery. **Subject for discussion**: Abdominal aorta - unpaired branches. Accessory nerve (CNXII).	4
12.	**SEMINAR:** Pleura. Pericardium. Mediastinum. Skeletotopy, holotopy and synotopy of thoracic organs.	2
13.	Regio frontoparietooccipitalis. Anterior region of the neck (regio colli anterior) - reflecting of the infrahyoid muscles. External carotid artery - branches. Thyroid gland. Middle mediastinum. Pericardium. Removal and opening of the small intestine. Inferior mesenteric artery. **Subject for discussion**: System of superior cava vein. Brachiocephalic veins.	2
14.	**SEMINAR:** Heart. Topography and boundaries. Removal of the heart - external morphology. Dissection of the heart: internal structure, cavities, valves; blood vessels. Inspection of the aorta.	2
15.	Temporal region (regio temporalis) - temporal muscle (m. temporalis). Regio parotideomasseterica - deep layer. Regio colli anterior - suprahyoid muscles. Reflecting of myohyoidal muscle. Branches of the external carotid artery. Hypoglossal and lingual nerves., glossopharyngeal nerve, vagus nerve (n. vagus) and accessory nerve. Superior mediastinum. Intermediate and prevertebral objects. Superior part of the abdominal cavity - bursa omentalis. Celiac trunk. Reflection and preparation of the large intestine. **Subject for discussion**: Thoracic aorta - branches. Glossopharyngeal nerve (CNIX)	2
16.	Terminal branches of the external carotid artery. Facial nerve (CN VII). Sternocleidomastoid region - deep layer. Regio colli lateralis. Omoclavicular and omotrapezoid triangle. Hilum of the lungs. Bronchi, blood vessels, nerves and lymph nodes. Removal and preparation of the stomach. Complete presentation of the branches of the celiac trunk. System of the portal vein. **Subject for discussion**: System of inferior vena cava. System of portal vein. Intersystemic anastomoses.	2

17.	Infratemporal region-superficial objects (maxillary artery). Regio colli lateralis - deep layer. Removal and preparation of the lungs. Skeletotopy. Removal and preparation of the liver, duodenum, pancreas and spleen. **Subject for discussion**: Vagus nerve (CNX). Maxillary artery.	2
18.	Infratemporal region - deeply situated objects. Trigeminal nerve (CNV). Muscles of chewing. Prevertebral lamina of cervical fascia. Posterior mediastinum. Thoracic aorta. Thoracic duct. Retroperitoneal space. Renal hilum. Suprarenal gland. Inferior vena cava. **Subject for discussion**: Trigeminal (CNV) nerve. Veins of the thoracic wall and superior abdominal wall.	2
19.	Connection between head and neck. Cervical part of the sympathetic trunk. Veins of the thoracic wall. Thoracic part of the sympathetic trunk. Paired branches of the abdominal aorta. Abdominal part of the sympathetic trunk. Pelvis - peritoneal part. **Subject for discussion**: Sympathetic trunk. Abdominal aorta - paired branches.	2
20.	Craniocerebral topography. Removal of the brain. Orbltal region - superior part. NECK: Internal cervical organs. Skeletotopy and syntopy. Muscles of the thorax. Definitive presentation of the objects on the inner surface of the thoracic wall. Reflection of the kidneys and suprarenal glands. Posterior abdominal wall - muscles. Lumbar plexus. Pelvis - subperitoneal part. **Subject for discussion**: Lumbar plexus - origin and formation, branches. Internal and external iliac arteries.	4
21.	Orbltal region - middle and inferior part. Cranial nerves. Deep muscles of the neck. Diaphragm. Pelvis - subperitoneal part. Sacral plexus. Subject for discussion: Exrtinsic muscles of the eye. Cranial nerves. Ophtalmic artery.	2
22.	Interior of the base of the skull (basis cranii interna). Pelvis - subcutaneous part, superficial layer. **Subject for discussion:** Perineum. Pudendal nerve. Internal pudendal artery.	2
23.	Pelvis - subcutaneous part - deep layer. **Subject for discussion:** Parasympathetic nerves from spinal origin	2
24.	Dissection of external genitalia and pelvic organs	2
25.	Discussion on the crafted organs by regions of the back, head, neck, chest, abdomen and pelvis.	2
26.	**Colloquium on back, head, neck, chest, abdomen and pelvis (cadaver).**	2
	9. B. DISSECTION COURSE WITH TOPOGRAPHIC ANATOMY - UPPER AND LOWER LIMBS	
	LECTURE COURSE - 4 hours	
№	Topic	Hours
	IVth semester	
1.	Topographic anatomy of the upper limb	2
2.	Topographic anatomy of the lower limb.	2
	9B. DISSECTION COURSE WITH TOPOGRAPHIC ANATOMY - UPPER AND LOWER LIMBS	
	PRACTICAL EXERCISES - 20 hours	
	Topic	
	IVth semester	

№	Topic for discussion	Upper limb dissection	Lower limb dissection	Hours

1.	Topographic anatomical regions of the limbs. Superficial veins and cutaneous nerves of the limbs.	Skin incisions; skin removal in the deltoid, axillary and elbow regions. Dissection of superficial veins and skin nerves.	Skin incisions; skin removal in the gluteal, thigh and knee regions. Dissection of superficial veins and skin nerves.	2
2.	Brachial and sacral plexus - formation and main branches. Topographic-anatomical features of the deltoid, scapular and gluteal regions.	Deltoid region - deltoid muscle. Subdeltoid space - vessels and nerves. Scapular region - subcutaneous layer.	Gluteal region - superficial layer, gluteal fascia, gluteus maximus muscle. Posterior area of the thigh - superficial layer: cutanous nerves, fascia.	2
3.	Axillary artery. External and internal iliac artery. Topographic-anatomical features of the anterior brachial and anterior elbow regions. Topographic-anatomical features of the posterior femoral and posterior knee regions.	Presentation of the brachial plexus, axillary artery and veins. Anterior brachial region - superficial layer, fascia, muscles, vessels. Anterior elbow region - suprafascial layer (veins, cutaneus nerves).	Gluteal region - deep layer: muscle layers, vascular-nerve bundles. Posterior region of the thigh - muscles, vessels, nerves. Posterior region of the knee - surface layer, fascia. Popliteal fossa - vessels, nerves, muscles.	2
4.	Lumbar plexus - formation branches. Femoral and popliteal artery. Brachial muscles, arteries and nerves. Topographic-anatomical features of the anterior femoral region.	Anterior brachial regior (vascular-nerve bundle) Anterior cubital region – deep layer (cubltal fossa). Ulna grooves and vascular-nerve bundles.	Representation of the sacral plexus. External and internal iliac arteries - branches. Anterior group of muscles around the hip joint. Anterior thigh region – subcutaneous layer, fascia, spaces and canals (lacunae, femoral and obturator canal). Femoral triangle.	2
5.	Topographic-anatomical features of the posterior brachial region, the posterior elbow region and the anterior region of the knee.	Scapular region - deep layer, muscles, vessels, nerves. Posterior brachial region – subcutaneous layer, fascia, muscles, vessels and nerves. Posterior elbow area.	Anterior region of the thigh - deep layer: femoral artery and vein, adductor canal. Anterior area of the knee.	2
6.	Topographic-anatomical features of the anterior region of the forearm and the anterior region of the lower leg	Removal of the skin on the forearm and back of the hand. Dissection of the superficial veins and nerves of the forearm and back of the hand.	Removal of the skin on the lower leg and the dorsal part of the foot. Development of the superficial veins and cutaneous nerves of the lower leg and the dorsal part of the foot.	2

7.	Arteries, veins and nerves of the forearm. Topographic anatomical features of the dorsal part of the foot.	Forearm fascia. Anterior area of the forearm - muscle layers, vascular-nerve bundles.	Lower leg fascia. Anterior region of the lower leg - muscles, vessels, nerves. Dorsal part of the foot - fascia, muscles, vessels, nerves.	2
8.	Arteries, veins and nerves of the lower leg. Topographic anatomical features of the posterior region of the forearm and wrist.	Posterior region of the forearm. Posterior carpal region – fascia, vessels and nerves (osteofibrous canals).	Posterior region of the lower leg - fascia, muscle layers, vessels and nerves. Heel region - fascial formations, vessels.	2
9.	Arteries, veins and nerves of the hand. Topographic anatomical features of the palm and the fingers.	Removal of the skin on the palm and fingers. Anterior carpal area. Palm - palmar aponeurosis, medial, middle and lateral fascial compartment. Fingers - vessels and nerves.	Removal of the skin on the foot and toes. Foot - aponeuroses, medial, middle and lateral compartment. Fingers - vessels and nerves.	2
10.	Arteries, veins and nerves of the foot. Topographic-anatomical features of the foot and toes.	Palm - deeply located objects: tendon sheaths, deep palmar arch, muscles, nerves. Fingers - tendon sheaths.	Стъпало – дълбоко разположени обекти (сухожилни влагалища, мускули и нерви). Пръсти – сухожилни влагалища.	2
	Colloquium on upper and lower limbs.			

Questionary

Anatomy and histology
Specialty "Medicine"

Educational and qualification degree "MASTER", professional qualification "PHYSICIAN"

I. Osteology and Arthrology

1. General teaching about bones. Shape and internal structure of bones. Bone as an organ.
2. Development and growth of bones.
3. Skull roof.
4. Internal surface of the skull base.
5. Outer surface of the skull base.
6. Lateral surface of the skull.
7. Eye socket (orbit).
8. Bony skeleton of the nasal cavity.
9. Connections of bones - types. Continuous connections.
10. Discontinuous connection by joints. Device and biomechanics of the joint.
11. Connections of the spine. The spine as a whole. Age characteristics.
12. Connections of the thorax. Thorax as a whole. Age characteristics.

13. Connections of the skull with the spine.
14. Connections of the had bones. Age characteristics.
15. Mandibular joint.
16. Joints of the shoulder girdle. Age characteristics.
17. Shoulder joint. Age characteristics.
18. Elbow joint. Connections of the bones of the forearm. Age characteristics.
19. Wrist joints. Age characteristics.
20. Carpal-metacarpal joints. Joints of the fingers of the hand. Age characteristics.
21. Joints and ligaments of the pelvic girdle. The pelvis as a whole. Age characteristics.
22. Hip joint. Age characteristics.
23. Knee joint. Age characteristics.
24. Connections of lower leg bones. Upper ankle joint. Age characteristics.
25. Joints of the sole. Age characteristics.
26. Tarso-metatarsal joints. Joints of the toes. Age characteristics.
27. General principles of Imaging Anatomy.

II. Myology

28. Skeletal muscles - structure; types of muscles. The muscle as an organ.
29. Accessory formations of muscles and tendons. Internal and external mechanics of muscles
30. Mimic muscles.
31. Masticatory muscles.
32. Superficial muscles of the back.
33. Deep muscles of the back. Fascia of the back.
34. Muscles of the neck. Superficial and sublingual muscles.
35. Deep neck muscles. Cervical fascia.
36. Muscles of the thorax: pectoral muscles of the shoulder girdle, proper muscles of the thoracic wall. Pectoral fascia.
37. Diaphragm.
38. Abdominal muscles. Fascia of the abdominal wall, function of the abdominal muscles.
39. Inguinal canal.
40. Muscles of the shoulder girdle (proper).
41. Brachial muscles. Brachial fascia.
42. Muscles of the forearm - anterior group. Forearm fascia.
43. Muscles of the forearm - lateral and posterior groups. Forearm fascia.
44. Hand muscles.
45. Muscles around the hip joint.
46. Muscles of the thigh. Femoral fascia.
47. Muscles of the lower leg - anterior and lateral groups.
48. Muscles of the lower leg - posterior group. Lower leg fascia.
49. Muscles and fascia of the foot.

III. Splanchnology

50. General principles of structure of the internal organs.
51. Digestive system - general principles of structure of its organs, ontogenesis.
52. Oral cavity - parts. Ontogenesis and malforamtions of the face and oral cavity.
53. Oral cavity - oral vestibule. True oral cavity. Lips. Cheeks.
54. Oral cavity - soft and hard palate. Oral mucosa.
55. Tongue. Structure. Blood supply, lymphatic drainage and innervation.
56. Teeth - structure of the teeth. Blood supply, lymphatic drainage and innervation. Embryonic development of teeth.
57. Teeth - temporary and permanent dentition. Eruption of milk and permanent teeth.

58. Oral isthmus. Tonsils (tonsils). Waldeyer's lymphoid ring.
59. Glands of the oral cavity - small and large salivary glands. Blood supply, lymphatic drainage and innervation.
60. Pharynx. Topography. Structure. Blood supply, lymphatic drainage, innervation.
61. Esophagus - topography, structure. Blood supply, lymphatic drainage, innervation.
62. Stomach - shape, parts, topography. X-ray image. Blood supply, lymphatic drainage, innervation.
63. Stomach - wall structure.
64. Duodenum. Topography. Structure of the wall. Blood supply, lymphatic drainage, innervation.
65. Mesenteric small intestine (jejunum and ileum). Topography. A device on the wall. Blood supply, lymph outflow, innervation.
66. Colon: cecum, appendix. Topography. A device on the wall. Blood supply, lymphatic drainage, innervation.
67. Large intestine: colon. Topography. Structure of the wall. Blood supply, lymphatic drainage, innervation.
68. Colon: rectum. Topography. Structure of the wall. Blood supply, lymphatic drainage, innervation.
69. Pancreas. Topography. Microscopic construction of the exocrine and endocrine parts. Blood supply, lymphatic drainage, innervation.
70. Liver - topography, external morphology. Parts and segments of the liver. Blood supply, lymphatic drainage, innervation.
71. Liver. Internal structure - liver lobules, liver cells, sinusoids, bile ducts of the liver.
72. Gallbladder and extrahepatic bile ducts. Blood supply, lymphatic drainage, innervation.
73. Abdomen (peritoneum) - general data, relationship with the abdominal organs. Course in descending and transverse direction.
74. Peritoneal cavity: upper abdominal region, lower abdominal region, pelvic region; peritoneal formations in them; communications.
75. Respiratory system. General principles of the structure. Ontogenesis.
76. Outer nose. Nasal cavity. Blood supply, lymphatic drainage, innervation.
77. Paranasal cavities (sinuses).
78. Larynx - cartilages, joints between cartilages, muscles.
79. Larynx - topography, cavity, mucosa. Blood supply, lymph outflow, innervation.
80. Breathing tube. Bronchi. Topography. Structure of the wall. Blood supply, lymph outflow, innervation.
81. Lungs. Shape, size, topography. X-ray anatomy. Blood supply, lymphatic drainage, innervation. Parts, segments.
82. Lungs – anatomical-functional units - particles, acini.
83. Pleura, pleural cavity. Borders of the parietal pleura.
84. Urinary-Reproductive system. General principles of structure. Ontogenis.
85. Kidney - shape, topography, attachment apparatus. Blood supply, lymphatic drainage, innervation. Renal malformations.
86. Kidney - internal structure; endocrine system of the kidneys.
87. Excretory tracts of the kidney - renal pelvis, ureter. Topography. X-ray image. Blood supply, lymphatic drainage, innervation.
88. Urinary bladder. Topography. Structure of the wall. Blood supply, lymphatic drainage, innervation. Malformations.
89. Male and female urethra. Topography. Structure of the wall. Blood supply, lymphatic drainage, innervation.
90. Reproductive systems (sexual organs): ontogenesis.
91. Tesis; epididymis. Topography. Macroscopic structure. Topography. Microscopic structure. Blood supply, lymphatic drainage, innervation.
92. Ductus defference; seminal vesicles. Topography. Microscopic structure. Blood supply, lymphatic drainage, innervation.

93. Seminal cord. Sheaths of the testis. Scrotum.
94. Prostate gland; bulbourethral glands. Topography. Microscopic structure. Blood supply, lymphatic drainage, innervation.
95. Male copulatory organ (penis). Macroscopic and microscopic structure. Blood supply, lymphatic drainage, innervation.
96. Ovary. Topography. Microscopic structure. Blood supply, lymphatic drainage, innervation.
97. Uterine tube. Topography. Microscopic structure. Blood supply, lymphatic drainage, innervation
98. Uterus. Topography. Microscopic structure. Blood supply, lymphatic drainage, innervation.
99. Vagina; external female genitalia. Topography. Microscopic structure. Blood supply, lymphatic drainage, innervation.
100. Perineum.
101. Mammary gland. Topography. Microscopic structure. Blood supply, lymphatic drainage, innervation.

IV. Endocrine system
102. Endocrine glands. General anatomical features.
103. Pituitary gland - general data. Adenohypophysis. Microscopic structure. Connections of the adenohypophysis with the hypothalamus.
104. Pituitary gland - general data. Neurohypophysis. Microscopic structure. Connections of the neurohypophysis with the hypothalamus.
105. Epiphysis (pineal gland). Topography. Microscopic structure. Blood supply, lymphatic drainage, innervation.
106. Thyroid gland. Topography. Microscopic structure. Blood supply, lymphatic drainage, innervation.
107. Parathyroid glands. Topography. Microscopic structure Blood supply, lymphatic drainage, innervation.
108. Adrenal glands. Topography. Microscopic structure. Blood supply, lymphatic drainage, innervation. Paraganglia.
109. Gastro-entero-pancreatic endocrine system. Microscopic structure.

V. Cardiovascular system, lymphatic system
110. Blood circulatory system. General data.
111. Heart - topography, external morphology, X-ray Anatomy of the heart.
112. Cavities of the heart. Heart valves.
113. Structure of the wall of the heart. Fibrous skeleton. Cardiac septum.
114. Impulse conduction system. Innervation of the heart.
115. Blood and lymphatic vessels of the heart.
116. Pericardium. Pericardial cavity.
117. Ontogenesis of the heart.
118. Organizational plan of the circulatory system. Arterial and venous parts of the circulatory system. Anastomoses - types. Collateral circulation.
119. Blood circulation of the fetus.
120. Stucture of the wall of blood vessels. Structure of the arterial wall; blood supply, innervation.
121. Microcirculatory bed: types, arterioles, capillaries, venules. Arterio-venous anastomoses.
122. Structure of the venous wall and the venous valves. Blood supply and innervation.
123. Vessels of the pulmonary circulation.
124. Aorta - overview, parts and branches: ascending aorta, aortic arch, thoracic aorta, abdominal aorta.
125. External carotid artery.
126. Internal carotid artery.
127. Maxillary artery.

128. Subclavian artery.
129. Axillary and brachial artery.
130. Arteries of the forearm and hand (radial and ulnar arteries).
131. Ways of collateral blood circulation of the upper limb.
132. Branches of the thoracic aorta.
133. Branches of the abdominal aorta - upper and lower mesenteric arteries.
134. Branches of the abdominal aorta - intestinal trunk, truncus celiacus.
135. Paired branches of the abdominal aorta.
136. Common iliac artery. Internal iliac artery.
137. External iliac artery. Femoral artery.
138 Popliteal artery. Arteries of the lower leg and foot.
139. Ways of collateral blood circulation of the lower limb.
140. System of the superior vena cava - veins of the head and neck.
141. Veins of the upper limb.
142. Veins of the thoracic wall and the upper part of the abdominal wall.
143. System of inferior vena cava.
144. Veins of the pelvis and the lower part of the abdominal wall.
145. Veins of the lower limb.
146. Portal vein system.
147. Intersystem anastomoses. Cava-caval and porto-caval anastomoses.
148. Lymphatic system - overview and structural plan. Lymph vessels - structure.
149. Lymph follicles and lymph nodes - structure.
150. Lien. Topography. Microscopic structure . Blood supply, lymph outflow, innervation.
151. Thymus. Topography. Microscopic structure. Blood supply, lymph outflow, innervation.
152. Bone marrow. Microscopic structure.
153. Lymphatic vessels and regional lymph nodes of the head and neck.
154. Lymphatic vessels and regional lymph nodes of the thorax and upper limb.
155. Lymphatic vessels and regional lymph nodes of the abdomen.
156. Lymph vessels and regional lymph nodes of the pelvis and lower limb.

VI. Nervous system and sensory organs

157. Nervous system - general data. General principles of nervous system organization.
158. Basic principles of histophysiology of the nervous system.
159. Ontogenic development of the nervous system.
160. Spinal cord - macroscopic struture
161. Cytoarchitectonics of the spinal cord.
162. White matter of the spinal cord.
163. Sheaths and blood supply of the spinal cord.
164. Brain - general features, parts, embryonic development.
165. Medulla oblongata.
166. Pons.
167. Midbrain.
168. Cerebellum - lobules and nuclei.
169. Internal structure of the cerebellum: structure of the cortex.
170. White matter of the cerebellum: afferent and efferent connections of the cerebellum. Functions.
171. Midbrain.
172. Metathalamus, epithalamus, subthalamic region.
173. Hypothalamus.
174. Telencephalon: cerebrum hemispheres - grooves, folds and lobes.
175. Telencephalon - white matter.
176. Rhinencephalon.

177. Basal nuclei.
178. Limbic system.
179. Structure of the cerebral cortex.
180. Cortical fields: localization of functions in the cerebral cortex. Functional asymmetry of the cerebral hemispheres.
181. Meninges of the brain.
182. Blood supply of the brain. Blood brain barrier.
183. Lateral brain ventricules.
184. Third and fourth brain ventricules.
185. Formation and circulation of cerebrospinal fluid. Blood-CSF barrier.
186. Sensory systems - superficial mechanoreception system.
187. System of sensation for pain and temperature.
188. Deep sensory system (proprioreceptive sensory system).
189. Pathways for general sensation (superficial and deep) from the head region - trigeminal sensory system.
190. System of interoceptive sensibility.
191. Visual-sensory system.
192. Auditory-sensory system.
193. Vestibular-sensory system.
194. Taste-sensory system.
195. Olfactory-sensory system.
196. Motor system - general features. Pyramidal motor system, corticonuclear and oculomotor system.
197. Extrapyramidal system - motor system of the basal nuclei.
198. Extrapyramidal system - feedback circuits.
199. Limbic functional system.
200. Reticular formation.
201. Neuroendocrine system.
202. General arrangement of the autonomic nervous system
203. Segmental innervation of the skin and muscles. Zones of Head.
204. Spinal nerves.
205. Posterior (dorsal) branches of the spinal nerves.
206. Cervical plexus.
207. Brachial plexus - formation. Nerves of the shoulder girdle.
208. Brachial plexus - nerves of the free upper limb.
209. Anterior branches of the thoracic spinal nerves.
210. Lumbar plexus.
211. Sacral plexus.
212. Cranial nerves: overview, composition and functional analysis.
213. Nerves innervating eye muscles (III, IV and VI).
214. Trigeminal nerve (V) - general features, formation and objects of innervation.
215. N. ophthalmicus (V1).
216. N. maxillaris (V2).
217. N. mandibularis (V3).
218. Facial nerve (VII).
219. Vestibulocochlear nerve (VIII).
220. Glossopharyngeal nerve (IX).
221. Vagus nerve (X).
222. Accessory nerve (XI). Sublingual nerve (XII).
223. Sympathetic trunk – structure and parts.
224. Branches of the cervical part of the sympathetic trunk.

225. Branches of the thoracic, abdominal and pelvic parts of the sympathetic trunk.
226. Prevertebral ganglia of the sympathetic nervous system.
227. Parasympathetic nerves of spinal origin.
228. Vegetative nerve plexuses in the thoracic, abdominal and pelvic cavity.
229. Organ of vision - general features. Ontogenesis.
230. Eyeball: shape, dimensions. Outer fibrous tunic of the eyeball.
231. Vascular tunic of the eye: choroid, ciliary body.
232. Iris. Iridocorneal angle.
233. Inner tunic of the eye (retina).
234. Inner nucleus of the eyeball.
235. Auxiliary organs of the eye: muscles of the eyeball, lacrimal apparatus.
236. Blood supply of the eyeball.
237. Eyelids and conjunctiva.
238. Auditory-vestibular organ: parts. Ontogenesis.
239. External ear.
240. Middle ear: tympanic cavity. Auditory tube.
241. Tympanic membrane. Auditory ossicles.
242. Inner ear: bony labyrinth.
243. Membranous labyrinth: vestibular apparatus.
244. Organ of Corti.
245. Olfactory organ. Gustatory organ.
246. Skin. Microscopic structure. Blood supply, lymph outflow, innervation.
247. Skin glands and skin appendages. Microscopic structures.

VII. Topographic anatomy

248. Deltoid region.
249. Anterior region of arm.
250. Posterior area of the arm.
251. The elbow.
252. Anterior region of the forearm.
253. Posterior region of the forearm.
254. Wrist region.
255. Palm of the hand.
256. Dorsal part the hand.
257. Gluteal region.
258. Anterior region of thigh.
259. Posterior region of thigh.
260. Knee.
261. Anterior region of lower leg.
262. Posterior region of lower leg.
263. Heel region.
264. Dorsal part of the foot.
265. Sole of the foot.
266. Fronto-parieto-occipital region.
267. Temporal region. Mastoid region.
268. Skull base.
269. Infratemporal region.
270. Lateral region of the face.
271. Ocular region.
272. Nasal region. Paranasal sinuses. Communications.
273. Mouth region.

274. Fasciae and connective tissue spaces of the neck.
275. Anterior region of the neck.
276. Submandibular triangle.
277. Carotic triangle.
278. Sternocleidomastoid region.
279. Lateral region of the neck.
280. Subclavian region.
281. Mammary region.
282. Axillary region.
283. Thoracic wall.
284. Mediastinum.
285. Anterior abdominal wall.
286. Inguinal canal.
287. Upper part of the abdominal cavity.
288. Lower part of the abdominal cavity.
289. Retroperitoneal space.
290. Peritoneal part of the pelvis.
291. Subperitoneal part of the pelvis.
292. Topographic relations of the pelvic organs, vessels and nervous formations.
293. Subcutaneous part of the pelvis.
294. Posterior region of the neck.
295. Scapular region. Subscapular region. Lumbar region.
296. Regio vertebralis. Spinal canal and its contents.

TEXTBOOKS:

1. Drake RL, Vogl AW and Mitchell AWM. GRAY'S ANATOMY FOR STUDENTS.3rd ed., Churchill Livingstone, 2014.
2. Saladin K. HUMAN ANATOMY.4th ed. McGrow-Hill, 2014.
2. Mescher A. JUNQUEIRA'S BASIC HISTOLOGY. TEXT AND ATLAS.15th ed. McGraw- Hill. 2018.
3. Gartner LP and Hiatt JL. COLOR ATLAS AND TEXTBOOK OF HISTOLOGY.6th ed. Saunders, 2013.
4. Ross M and Pawlina W.HISTOLOGY. A TEXT AND ATLAS WITH CORRELATED CELL AND MOLECULAR BIOLOGY.7th ed. Lippincott Williams & Wilkins, 2015.
5. Tank, P. GRANT'S DISSECTOR.15th ed. Walter Kluwer -Lippincott, Williams & Wilkins, 2013.
6. Morton D, Peterson K and Albertine K. GRAY'S DISSECTION GUIDE FOR HUMAN ANATOMY.2nd ed. Churchill Livingstone, 2007.
7. Moore, K .ESSENTIAL CLINICAL ANATOMY.5th ed. Lippincott, Williams & Wilkins, 2014.
8. Hansen, J. Netter's Clinical Anatomy. 3rd ed., Saunders, 2014
9. Sadler TW. MEDICAL EMBRYOLOGY.13th ed. Lippincott, William & Wilkins, 2014.

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/Prof. Ivaylo Stefanov, MD, PhD/

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(Chief Assis. Prof. Ruska Nenkova, PhD)

Approved by a decision of the Council of the Department of Anatomy, Histology, Embryology, Pathology, Latin, Forensic Medicine and Ethics, Protocol № 25/.08.11.2023г.

Head of Department:.....

(Prof. Minko Minkov, MD, PhD)

Approved by a decision of the Council of the Faculty of Medicine, Protocol № 46/09.11.2023г.

Secretary of the Council of the Faculty of Medicine: ....

(Chief Assis. Prof. Ruska Nenkova, PhD)

UNIVERSITY "PROF. DR. ASEN ZLATAROV" - BURGAS
FACULTY OF "PUBLIC HEALTH AND HEALTHCARE"
DEPARTMENT OF "PHYSICAL EDUCATION AND SPORTS"

Approved by!
DEAN:
/Prof. Valentin Vasilev, PhD/

SYLLABUS

Discipline:	**PHYSICAL EDUCATION AND SPORTS**
Specialty:	**MEDICINE**
Professional field:	**7.1. Medicine**
Educational and qualification degree:	**MASTER**
Form of training:	**REGULAR**

Burgas, 2023

EXTRACTS FROM THE CURRICULUM

1. GENERAL PARAMETERS OF THE DISCIPLINE			
Total (academic hours):	120	**ECTS:**	4
Auditorium classes	**Non-auditorium classes**	**Auditorium ECTS**	**Non-auditorium ECTS**
60	60	2	2
Type of Discipline:	**Academic hours per week: /lectures + practices/**	*Course:*	*Semester:*
Mandatory	0 +2	**I**	**I, II**

2. STUDY FORMS					
Auditorium classes:	**Academic hours**	**ECTS**	**Non-auditorium classes:**	**Academic hours**	**ECTS**
Lectures	0		**Consultation**	30	1
Practices	60	2	**Individual work** - Preparing for the exam	30	1

3.EVALUATION AND CONTROL	
Forms of evaluation and control	**Relative share in the total score**
Sessional evaluation: exam	**0.4**
Semester (ongoing) assessment:	**0.6**
Forms of semester control:	
attendance and active participation in practical exercises	0.2
participation in student competitions and tournaments	0.2
assessment of physical capacity	0.2

ANNOTATION

of the discipline "Physical Education and Sports"

Purpose of the study discipline

The study discipline "Physical education and sport" is intended for students from the specialty "Medicine" - "Master degree", regular form of education.

Objectives:

1. Preserving and improving the students' health and physical capacity.
2. Improving motor skills, habits and physical qualities of students.
3. Improving skills in basic sports (basketball, volleyball, football, handball, gymnastics, athletics, tennis)
4. Developing spatial orientation skills in an unfamiliar environment.
5. Developing skills for a healthy and environmentally friendly lifestyle.
6. Developing a competitive spirit and competitive ability through participation in various rank competitions - internal, bilateral meetings, municipal competitions, student games, etc.
7. Overcoming stressful conditions and reducing nervous tension through tourist activities and outdoor sports activities.
8. Developing teamwork skills, organizational skills and time and environment management skills, problem solving skills.

Structure of the learning content:

The highlights of the developed curriculum for the discipline "Physical Education and Sport" are related and cover the following areas:

- Interrelationship between the motor training and the professional realization of the students
- Significance of the basic motor qualities for practicing the chosen profession;
- Professional-applied motor training, as a factor for optimizing students' sports training;
- Morphological and functional improvement of the students' body, development of motor qualities, skills and habits;
- Unity of motor and psychological activity of learners;
- Significance of motor activity for maintaining a high level of motor fitness and interrelationship with the professional realization of the students
- Professional-applied motor training and a healthy lifestyle as factors for increasing the effectiveness of students' training;
- Interrelationship between motor activity and healthy lifestyle among students;
- Morpho-functional and psychophysical improvement of students to develop motor qualities, skills and habits, improve vital functions and reduce the impact of risk factors.

The mentioned topic contributes to the preparation of qualified and psychophysically stable specialists with higher education (possessing a high degree of motor culture and healthy habits) to be realized in the chosen profession.

The learning content in the program is presented in general physical fitness classes.

The classes for general physical training cover the first year /first and second semester/. The educational content is presented in a thematic form / each thematic unit covers ten sports

(athletics, combined gymnastics, basketball, volleyball, football, handball, tennis, badminton, table tennis, fitness / bodybuilding).

To satisfy the sports interests and desires of the students to practice their favorite sport with a tendency for future improvement, the opportunity is given to participate in additional specialized sports training. The specialized sports preparation creates the opportunity to choose a sport and participate for outstanding students in friendly matches, intra-university tournaments and university tournaments.

The curriculum is designed considering the functional status, the student's workload and the ability to recover after classes. It is a one-to-one open system, in which, depending on the sports base, the conditions in places and the sports personnel, other types of sports can be included.

Teaching methods:

1. Methods of education: persuasion, personal example.
2. Methods of training:

- group, round, station and individual;
- verbal: narrative, conversation, explanation, description, instruction, analysis, commands, analysis and synthesis;
- visual: through audiovisual technical means, direct telling and demonstration by the teacher (trainer).

3. Methods of verification and control of the activity: observation, testing, discussion, survey, competition and others.

Evaluation methods:

The discipline ends with an exam. The grading ratio is 6:4 in favor of the results shown in the current work during the semester. Forms of semester control:

1. Attendance and active participation in practical exercises.
2. Participation in student competitions and tournaments.
3. Compilation of a complex of exercises for different muscle groups.
4. Assessment of physical capacity - testing

Test No. 1 LONG JUMP FROM A PLACE WITH TWO LEGS (cm.)
MEN AND WOMEN

Equipment: Rough surface, line and measuring tape (the tape is attached to the ground immediately next to the rough surface so that the result of the jump can be easily measured).

Description of the test: The subject stands with the tips of the fingers next to the jump line. He swings his arms back, then sharply brings them forward and, pushing off with both legs, jumps as far as possible.

Result: The length of the jump in centimeters (of the best of three attempts with an accuracy of 1 cm.)

General Rules and Notes:

• The length of the jump is measured from the line to the rearmost mark left by the bouncer's foot on the surface.

• If the subject has fallen back and touched the floor with another part of the body, the attempt is not counted and he is offered to repeat it.

• It is not allowed to lift the feet off the floor before the jump

TEST No. 2 – ABDOMINAL PRESSES (Crunches) - (no.p.)
WOMEN

Equipment: Mat. A partner is also needed.

Description of the test: The subject takes i.p. occiput on the mat. The distance between his feet is approximately 30 cm. The fingers of the hands are intertwined under the head.

The partner kneels and holds the examinee's feet so that he does not lift off the mat. When the subject is ready, the command "Start!" is given. Then he goes into a "sitting" position and touches his elbows to his knees. It is then returned to the i.p. and touches the mat with his back and hands. Then he stands up again until "se-dezh" and so on. The exercise is repeated a maximum number of times until failure.

Result: The number of lifts from "back leg" to "seat" to failure.

General instructions and notes:

- During the test, the hands must be clasped behind the head.
- Each time, the examinee must return to the i.p., touching the mat with his fingers and back.
- Pushing off the mat with elbows and a sponge is not allowed.
- The exercise should be performed without interruption, but if the subject nevertheless makes several stops, the testing should not be stopped.

TEST No. 2 – Push ups – (items)
MEN

Equipment: The exercise is performed on a soft mat to be comfortable on the hands.

Test description: The subject stands on the ground with hands shoulder-width apart, fingers pointing forward. When the research has taken a starting position, the "Start!" command is given. The arms are bent until the chest touches the mat placed for this purpose. The arms are then immediately extended fully, the whole time the body is straight and does not bend. The exercise is repeated as many times as possible (until failure).

Score: Number of arm curls and extensions to failure.

General instructions and notes:

- Each examinee is given the right to only one attempt.
- It is forbidden for the examined person to help himself.
- Testing is terminated if the examined person stops the exercise for more than 2 seconds; if the examined person does not perform the entire contraction-touch and stretch movement two times in a row.

TEST No. 3 THROWING A SOLID BALL (m)
MEN AND WOMEN

Performed by: all subjects (for women a ball weighing 1 kg., for men a ball weighing 3 kg.)

Equipment: On a flat surface with non-slip hard or hard elastic flooring. A tape measure is stretched in the direction of throwing. The zero of the tape measure is on the throw line.

Description of the test: Starting position: standing, feet shoulder-width apart, toes touching a drawn line, palms tightly covering the ball from the side-back with slightly spread fingers, the ball is high above and slightly in front of the head.

Execution: The subject takes the body and arms strongly back once and throws the ball forward and up. The distance from the throw line to where the ball touches the support is measured.

Result: measurement to the nearest 1 cm (eg 7.35). Research has the right to three attempts, recording the best result.

General Rules and Notes:

• Passing in front of the throw-in line after the ball is in the air is not allowed.

• If the examiner has stepped forward and crossed the line with his foot, the attempt is not counted and he is offered to repeat it.

• No jumping with the feet off the floor before throwing is allowed

- **STANDARDS FOR PHYSICAL DISABILITY**
- **Men**

Jump on distance from place (cm)	Points	Push-ups (num.)	Points	Throwing of medicine ball 3 kg. (m.)	Points	Number of points from the three standards	Evaluation
under 190	0	under 20	0	until 7.20	0	13-15	6
191-200	1	21-25	1	7.21-8.10	1	10-12	5
201-210	2	26-30	2	8.11-8.70	2	7-9	4
211-220	3	31-35	3	8.71-9.30	3	4-6	3
221-230	4	36-40	4	9.31-10.20	4	under 3	2
over 230	5	over 41	5	over 10.20	5		

- **Women**

Jump on distance from place (cm)	Points	Ab-dominal presses (num.)	Points	Throwing of medicine ball 3 kg. (m.)	Points	Number of points from the three standards	Evaluation
under 150	0	under 20	0	until 5.00	0	13-15	6
151-160	1	21-30	1	5.01-5.80	1	10-12	5
161-170	2	31-40	2	5.81-6.60	2	7-9	4
171-180	3	41-50	3	6.61-7.20	3	4-6	3
181-190	4	51-60	4	7.21-8.00	4	under 3	2
over 190	5	over 60	5	over 8.00	5		

Requirements to pass the exam:
Regular participation in classes – an exam is given for 12 attendances.
Prerequisites for students' basic knowledge and skills:
Good physical and mental health.
Expected results:

1. Has advanced theoretical knowledge in the field of a healthy lifestyle through motor activity, including related to the latest achievements in physical education and sports.
2. Possesses practical skills, enabling activities with a chosen type of sport.
3. Assumes decision-making responsibilities in game situations, under the influence of various interacting and hard-to-predict factors
4. Shows initiative in sports activities.
5. Assesses the need for physical exercise and sports activities.

6. Forms and expresses his own opinion on problems related to the benefits of motor activity.
7. Teamwork skills.
8. Professional and social communication skills.

CURRICULUM CONTENT
PRACTICAL EXERCISES

TOPICS	Hours
1.Games for familiarization with the group and introduction to training in the disciplines "Physical education and sports". Safety briefing	2
2.Team building games - building a team, a team that allows the creation and development of collective values in the group. Values can be both unity born of interdependence and participation. They are achieved through game-type activities, often of a collective nature. Thanks to them, the participants gain their ability to work in a team. Teambuilding is an important factor in any environment that aims to bring out the best in the team to ensure development, positive communication, leadership skills and the ability to collaborate	4
3.Acquaintance with the essence of ATHLETICS FOR ALL and the content of training programs with athletics means for health.	4
4.CrossFit - creating an idea and knowledge about the development of motor skills with the means of athletics, weight lifting and gymnastics.	4
5.Bulgarian folk dances - our diverse folk art, as part of the folk culture of the Bulgarian people, has a beneficial effect on the overall development of the human organism and helps to adapt it to the constantly changing conditions and influences of modern reality	4
6.Volleyball: - Mastering group tactical actions – meeting an initial strike and organizing an attack. - Achieving and maintaining a good level of physical fitness	4
7.Basketball: - Mastering individual, group and team technical-tactical actions in attack and defense. - Achieving and maintaining a good level of physical fitness	4
8.Handball: - Mastering individual, group and team technical-tactical actions in attack and defense. - Achieving and maintaining a good level of physical fitness	4
9.Badminton: - Mastering technical and tactical actions in attack and defense - Achieving and maintaining a good level of physical fitness	4
10.Table tennis: - Mastering technical and tactical actions in attack and defense - Achieving and maintaining a good level of physical fitness	4
11.Football: - Mastering individual, group and team technical-tactical actions in attack and defense. - Achieving and maintaining a good level of physical fitness	4

12.Tennis court: - Mastering technical and tactical actions in attack and defense - Achieving and maintaining a good level of physical fitness	4
13.Combined gymnastics: - Combines different movement exercises from aerobics, yoga, pilates, calanetics, tae-bo, zumba and dance to provide the best physical training for the relevant muscle groups in a short time in a fun way	4
14.Fitness (bodybuilding): - Improving health and physical fitness through fitness activities - Optimizing the body composition and weight of the students, as well as increasing their mental and physical working capacity and general motor culture. - Selection of movements and their order to stimulate muscle growth to a base level, mostly due to hypertrophy through mainly myofibrillar muscles and high muscle tone. - Fitness classes are held in an indoor hall equipped with specialized equipment. Depending on the physical preparation of the students, an individual approach is applied.	10
Total:	**60 hours**

Compiled by:

(Assoc. Prof. Zlatka Dimitrova, PhD)

(Senior lecturer. Maria Bureva, PhD)

(Lecturer. Dobrin Perev) .....

The curriculum was discussed and adopted at a meeting of the "Physical Education and Sport „department, protocol No. 3 dated on .11.12.2020

The curriculum was adopted and discussed at the Faculty Council of the Faculty "Public health and healthcare" protocol No 29 of 14.10.2021.

The curriculum was updated at a meeting of the "Physical Education and Sports" department, protocol No. 2 of 22.11.2022.

The curriculum was updated at a meeting of the "Physical Education and Sports" department, protocol No. 3 of 04.11.2023.

Head of Department:

(Assoc. Prof. Zlatka Dimitrova, PhD)

The curriculum is coordinated with the department
"..... Medical Faculty ....."

Head of Department ...

(Assoc. Prof. R. Yankova, PhD

UNIVERSITY "PROF. DR. ASEN ZLATAROV" - BURGAS

MEDICAL FACULTY

DEPARTMENT OF PHYSICS, BIOPHYSICS, ROENTGENOLOGY AND RADIOLOGY

Approved by:

DEAN:

/Assoc. Prof. Rumyana Yankova, PhD/

SYLLABUS

Discipline:	**BIOPHYSICS**
Specialty:	**MEDICINE**
Professional field:	**7.1. MEDICINE**
Educational and qualification degree:	**MASTER**
Form of training:	**REGULAR**

Burgas, 2024

EXTRACTS FROM THE CURRICULUM

1. GENERAL PARAMETERS OF THE DISCIPLINE			
Total (academic hours):	150	**ECTS:**	5
Auditorium classes	**Non-auditorium classes**	**Auditorium ECTS**	**Non-auditorium ECTS**
60	90	2	3
Type of Discipline:	**Academic hours per week: /lectures + practices/**	*Cource:*	*Semester:*
Mandatory	2 + 2	I	II

2. STUDY FORMS					
Auditorium classes:	**Academic hours**	**ECTS**	**Non-auditorium classes:**	**Academic hours**	**ECTS**
Lectures	30	1	**Consultation**	10	0.3
Practices	30	1	Individual work - learning the course material	40	1.3
			- preparation of protocols	30	1.0
			- application of the acquired knowledge for solving computational tasks	5	0.2
			- use of Internet resources for additional information on a particular topic	5	0.2

3.EVALUATION AND CONTROL	
Forms of evaluation and control	**Relative share in the total score**
Sessional evaluation: exam	0.4
Semester (ongoing) assessment:	0.6
Forms of semester control	
- Attendance at classes	0.1
- Active participation in classes	0.2
- Preparation for practical classes	0.1
- Defense of protocols	0.3
- Colloquium	0.3

ANNOTATION

of the discipline "Biophysics"

Purpose of the course:

The discipline "Biophysics" is intended for the students of the specialty "Medicine" at the Faculty of Medicine, in a regular form of education, graduating with the educational-qualification degree "Master" and the professional qualification "Doctor".

Aims and Objectives

The Biophysics course aims to:

- Provide students with knowledge of the physical principles and regularities underlying the functioning of biological systems at all levels of their organization.
- Explain and clarify the physical and physicochemical processes underlying biological phenomena, physiological reactions, the mechanisms of occurrence and progress of pathological changes in living organisms, the action of pharmaceutical preparations, etc.
- Introduce students to modern models for describing the structure, properties and functioning of biological objects, as well as biophysical methods for their research.
- Develop students' skills in working with laboratory and medical equipment, as well as for preparing and conducting experimental research.

Structure of the learning content

The training course includes basic areas of biophysics as: equilibrium and elements of non-equilibrium thermodynamics and their applications in living systems; transformation of the energy in the cells; composition, properties and functions of biological membranes and their components; mobility and phase states of cell membranes; free radicals and consequences of oxidation of membrane components, antioxidant protection; transport processes of cells and tissues; electrical potentials in model systems and biopotentials; muscle contraction; electrical conductivity of cells and tissues for direct and alternating current; passive mechanical properties of tissues, mechanics of respiration and hemorheology.

Teaching methods

The lectures are accompanied by slide shows, video and animations that illustrate the processes in biological systems and the models for their functioning. Practical classes include laboratory experiments and computational tasks in order to apply and extend theoretical knowledge.

Forms of independent work:

Independent work of the students involves learning the course material, consideration of the theory and procedure of the lab exercises, processing and analysis of experimental results, preparation of protocols, preparing for exam using lecture notes, workbooks recommended by the teacher as well as Internet sources.

Assessment methods

Semester assessment is on base of current control during the practical exercises, colloquia and defence of protocols. Final grade is formed after theoretical exam (test, written and oral exam).

Prerequisites for students' basic knowledge and skills

Students should have basic knowledge in physics, chemistry, biology and mathematics and skills to apply them in solving computational, graphical and experimental tasks.

Expected results

Upon successful completing the Biophysics training course, students should have the following knowledge and skills:

- know the basic terms, definitions and laws in Biophysics;
- describe the physical properties and models, phenomena and processes of living organisms;
- know the biophysical basic of construction, organization and functioning of the biological objects at different levels of their organization;
- apply the acquired knowledge to explain the physiological processes living organisms;
- use the acquired biophysical methods to study biological objects;
- apply the acquired knowledge and practical skills in solving professional tasks and conducting research work.

CURRICULUM CONTENT

LECTURES

Topic	hours
1. Thermodynamics Basic concepts, terms and laws of thermodynamics. Thermodynamic potentials. Validity of principles in biological systems. Entropy changes in open systems.	3
2. Non-equilibrium thermodynamics Driving forces and flows in thermodynamic systems. Prigogine theorem. Steady state condition and dissipative structures.	2
3. Biological and model membranes Types of membranes. Functions and components of biological membranes. Lipid and protein molecules. Lipid associates: formation mechanisms and properties. Model lipid membranes.	2,5
4. Dynamics of biological membranes Mobility of the membrane components. Phase transitions in the lipid bilayer and their biological significance.	1,5
5. Free radicals in biological systems Free radicals: definition, formation and properties. Lipid peroxidation: causes and stages. Consequences of oxidation of membrane components and pharmaceutical preparations. Antioxidant protection.	2
6. Membrane transport Types and significance of membrane transport. Passive transport without carriers. Free diffusion of uncharged particles – Fick's laws, Stokes-Einstein equation.	3

Diffusion across a cell membrane. Osmosis and filtration. Exchange of water between blood and tissues. Facilitated diffusion: mechanisms and features.

7. Passive membrane transport of charged particles 1.5
Diffusion of ions. Nernst-Plank equation. Classification of ion channels. Ionophores: types and properties.

8. Active membrane transport 1.5
Essence, mechanisms and role of active membrane transport. Structure and function of sodium-potassium and calcium pump. Secondary active transport.

9. Electrical potential of membranes 2
Model potentials: generation of diffusion, equilibrium and Donnan potentials. Resting potential. Nernst and Goldman equations.

10. Action potential 2
Definition, properties and meaning of action potential. Prerequisites for generation. Hodgkin-Huxley theory of ion currents. Structure and properties of ion channels. Mechanism and speed of propagation.

11. Biophysics of muscle contraction 2
Molecular mechanism of muscle contraction. Regulation of contraction. Electromechanical processes. Types of muscle contraction.

12. Surface charge of cells 2
Origin of surface charge of the cells. Double electrical layer. Trans-membrane and electrokinetic potentials. Electrophoresis: types and applications.

13. Electrical conductivity of the cells and tissues 2
Flow of direct electric current through tissues. Types of polarization in biological systems. The alternating current conductivity of tissues. Impedance, polarization and static capacitance of biological objects. Dispersion of dielectric permittivity of tissues. Applications in medicine.

14. Biomechanics 3
Mechanical properties of biological tissues. Basic relations and models in rheology. Viscoelastic properties of bones and muscles. Mechanical properties of blood vessels. Biophysical basis of the external respiration.
Rheological properties of blood. Dependence of blood viscosity on hematocrit, deformability and aggregation of RBC.

Total academic hours: 30

PRACTICAL COURSE SYLLABUS

Topic	hours
1. Thermodynamics (seminar) Basic terms and principles of thermodynamics. Entropy, enthalpy, Helmholtz and Gibbs free energies – examples for determination of their changes at phase	2

transitions, reactions and processes in biological и процеси в биологични systems.

2. Determination of sizes of lipid molecules forming monolayer 2
Preparing a monolayer on water surface. Determination of length, cross-section and diameter of molecules of oleic acid.

3. Cupper-induced production of superoxide in erythrocyte membranes 2
Investigation of superoxide formation by copper-induced oxidation of erythrocyte membranes using a spectrophotometer.

4. Transport of substances across biological membranes (seminar) 2
Transport of substances across biological membranes - significance, types and mechanisms. Free diffusion of uncharged particles and ions. Diffusion across membrane, osmosis and filtration – basic equations and coefficients.

5. Studying diffusion across semipermeable membrane 2
Passive transport across membrane. Determination of the flux of the diffusion. Calculation of the permeability of membrane for various substances.

6. Studying the urea transport across semipermeable membrane 2
Basics of haemodialysis. Investigation of the dependence of urea concentration on time in a dialysis vessel. The determination of half – life time $t_{0.5}$ to reduce the concentration by half.

7. Determination of the osmotic resistance of erythrocytes 2

Study of the dependence of the volume of erythrocytes on the osmolarity of the medium. Determining the critical haemolytic volume of erythrocytes and calculating the area of their membrane surface.

8. Diffusion potential in a model system 2
Establishing the dependence of the diffusion potential on the concentration gradient in a model system. The determination of the ratio of mobilities of ions in the system.

9. Seminar: Biopotentials 2
Diffusion, equilibrium and Donan potential - conditions and mechanisms of occurrence, dependencies. Resting Potential - Theories of Occurrence, Goldman Equation; components of the potential. Determination of the potentials of model systems and biological membranes.

10. Research the electrical properties of the surface of cells 2
Types of electrophoresis - essence and applications. Calculation of the mobility of cells in an electric field. Determination of electrokinetic potential.

11. Equivalent electrical circuits for the study of the impedance of dispersion of biological tissues 2
Modeling of the impedance of biological tissues. Investigation of the frequency dependence of the impedance with equivalent electrical circuits of «live», «damaged» and «dead» tissue.

12. Measuring the resistance of uniform cell suspensions 2
Conductometric determination of the resistance of blood, erythrocyte suspension and blood plasma. Calculation of the volume index of the blood and comparison with the

values obtained with a hematocrit centrifuge.

13. Spectrophotometric determination of acidic hemolysis of erythrocytes 2
Hemolysis of erythrocytes. Distribution of erythrocytes by resistance. Determination of the differential hemolysis of erythrocytes and construction of an acid erythrogram.

14. Research viscoelastic properties of human skin in vivo 2
Passive mechanical properties of biological tissues. Nonlinear viscoelastic media. The determination of the pressure dependence of human skin deformation. Determination of Young's modulus.

15. Colloquium on the practicum and seminar classes from the biophysics course 2

Total academic hours: 30

BACKGROUND

for Biophysics exam
for students of the specialty "Medicine"

1. Thermodynamics subject and terms. Internal energy, heat and work. First law of thermodynamics.
2. Second law of thermodynamics. Statistical interpretation of entropy. Thermodynamic potentials: definition and consequences.
3. Energy transformation in biological systems. Types of work and heat in living organisms. Chemical and electrochemical potentials. Application of laws of thermodynamics in biological systems.
4. Non-equilibrium thermodynamics. Driving forces and flows. Steady state condition. Onsager relations. Prigogine theorem. Dissipative structures.
5. Importance of biological membranology. Types of membranes. Functions and composition of cell membranes. Membrane lipids – types and properties.
6. Functions and localization of membrane proteins and carbohydrates. Interrelations of membrane molecules. Models and conceptions of cell membrane structure.
7. Lipid associates and artificial membranes: formation mechanisms, types, properties and significance. Liposomes as pharmaceutical carriers.
8. Mobility of the membrane components: lateral and transverse diffusion. Liquid crystalline state of lipid bilayer. Phase transitions: molecular mechanisms and biological role.
9. Free radicals in biological systems: definition, formation and properties. Reactive oxygen forms.
10. Molecular mechanisms of the stress. Stages of the lipid peroxidation. Antioxidants: definition and types. Consequences of oxidation of membrane components
11. Types and significance of membrane transport. Simple diffusion of uncharged particles - Fick's laws, Stokes-Einstein equation. Diffusion of ions, Nernst-Plank equation.

12. Diffusion across a pore membrane. Osmosis and filtration. Dialysis and hemodialysis. Exchange of water between blood and tissues.
13. Facilitated diffusion. Ionophores – ion carriers (valinomycin) and channel-formers (gramicidin A).
14. Active transport. Sodium-potassium and calcium pump – significance, role of ATP, molecular structure and function.
15. Electrical potentials in model systems – diffusion, equilibrium and Donnan potential. Conditions and mechanisms of occurrence, concentration and time dependence of electrical potentials.
16. Resting potential – theories for the origin and components. Goldman equation.
17. Definition and importance of action potential. Hodgkin-Huxley theory. Structure and properties of ion channels. Mechanisms of propagation.
18. Molecular mechanism of muscle contraction. Electromechanical coupling. Propagation of excitation.
19. Surface charge of cells: origin and significance. Double electrical layer, electrokinetic potential. Electrophoretic mobility and its dependence on pH and ionic force of medium. Types and applications of electrophoresis.
20. Direct current conductivity of cells and biological tissues. Types of polarization in isolators and heterogeneous systems.
21. Alternating current conductivity of tissues. Impedance, polarization and static capacitance of biological objects. Dependence of the dielectric permittivity of tissues on the frequency. Applications in medicine.
22. Subject and importance of biomechanics. Rheology of biological materials, mechanical models. Viscoelastic properties of bones and muscles.
23. Passive mechanical properties of blood vessels: Lamé's equation, volume/pressure dependence. Pulse wave. Mechanics of respiration.
24. Hemorheology – rheological properties of blood. Dependence of blood viscosity on hematocrit, deformability and aggregation of RBC.

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5. Glaser R., Biophysics, An Introduction, Second Edition, Springer, Heidelberg, 2012.

Compiled by: ....
(Assoc. Prof. Dr. S. Kasarova)

.....
(Assist. Prof. M. Petrov)

Approved by a decision of the Council of the Department of Physics, Biophysics, Roentgenology and Radiology, Protocol № 1/13.02.2024.

Head of Department: ....
(Assoc. Prof. Dr. S. Kasarova)

Approved by a decision of the Faculty Council of the Medical Faculty, Protocol № 3/15.02.2024г

Secretary of the Council of the Medical Faculty: ....
(Chief Assist. Prof. Ruska Nenkova, PhD)

UNIVERSITY "PROF. DR. ASEN ZLATAROV" - BURGAS

MEDICAL FACULTY

DEPARTMENT OF INTERNAL DISEASES, SOCIAL MEDICINE, EMERGENCY MEDICINE, PHYSIOTHERAPY AND REHABILITATION MEDICINE

Approved by!
DEAN:
/Assoc. Prof. Rumyana Yankova, PhD/

SYLLABUS

Discipline:	**SOCIAL MEDICINE**
Specialty:	**MEDICINE**
Professional field:	**7.1. Medicine**
Educational and qualification degree:	**MASTER**
Form of training:	**REGULAR**

Burgas, 2024

EXTRACTS FROM THE CURRICULUM

1. GENERAL PARAMETERS OF THE DISCIPLINE			
Total (academic hours):	210	**ECTS:**	7

Auditorium classes	**Non-auditorium classes**	**Auditorium ECTS**	**Non-auditorium ECTS**
90	120	3	4

Type of Discipline:	**Academic hours per week: /lectures + practices/**	*Course:*	*Semester:*
Mandatory	1 + 3	**I, II**	**II, III**

2. STUDY FORMS					
Auditorium classes:	**Academic hours**	**ECTS**	**Non-auditorium classes:**	**Academic hours**	**ECTS**
Lectures	30	1	**Consultation**	30	1
Practices	60	2	**Individual work** - Preparation for colloquium - Preparation of protocols - Preparing for the exam	30 30 60	1 1 2

3.EVALUATION AND CONTROL	
Forms of evaluation and control	**Relative share in the total score**
Sessional evaluation: exam	**0.4**
Semester (ongoing) assessment:	**0.6**
Forms of semester control:	
- Attendance at classes	0.25
- Ongoing testing before each practical lesson	0.125
- Active participation in classes	0.125
- Control and tests	0.25
- Defense of protocols	0.25

ANNOTATION
of the discipline "SOCIAL MEDICINE"

Purpose of the course:

Annotation: The study discipline "Social medicine and health promotion" is intended for students from the "Medicine" specialty of the Master's College of Health Sciences from the professional field "health care", a regular form of education. It is studied in the 2nd semester of the 1st year and the 3rd semester of the 2nd year

Objectives: The main objective of training in the discipline "Social Medicine and Health Promotion" is to form students' knowledge, thinking style, approaches and practical skills adequate to modern sociomedical theory and practice, to the modern public health system, as well as and health investment activities and approaches.

Teaching methods

Forms of training: lectures, exercises

Training methods:

- ecture presentation
- practical exercises
- discussions
- individual and group practical tasks
- analysis of ready statistical information
- research of scientific literature
- independent preparation of a health promotion project
- self-training

Methods of control and evaluation of results: exam

- Continuous assessment with tests and quizzes. Evaluation of self-developed questionnaire and health education project
- Final assessment through test and written exam

Tasks:

- knowledge about the essence, priorities, trends and interrelationships of social medicine, public health and health promotion in modern healthcare;
- knowledge about the modern health policy and the ongoing health reform in our country, the priorities and trends of the policy for primary medical care and health promotion;
- knowledge and skills for analysis and assessment of medical and social problems and needs of individuals, social groups and communities;
- knowledge and skills regarding modern sociomedical technologies and integral, multidisciplinary approaches to solving the medical and social problems of individuals and society;
- knowledge and skills for training the population to increase health motivation, culture and personal responsibility for health

- knowledge and skills for working in multidisciplinary medical-social teams and multicultural environment;

Prerequisites for students' basic knowledge and skills

Students should have basic knowledge in the field of public health and medicine and skills to analyze health-demographic processes.

Expected results

At the end of the training in the discipline "Social Medicine and Health Promotion", the students should have formed and acquired:

- knowledge and skills for analysis and assessment of the essence, priorities and trends of modern healthcare policy and healthcare reform, as well as the role and place of social medicine and health promotion in the healthcare system;
- to identify the socio-health phenomena of the society, the indicators of negative and positive health, the health-demographic status of the population;
- knowledge and skills for the analysis of medical-social problems and needs of individuals, social groups and communities and modern socio-medical technologies and integral approaches to their solution;
- knowledge of the essence, priorities and trends of modern health promotion policy;
- knowledge and skills for training the population in a healthy lifestyle, to increase health motivation, culture and personal responsibility for better health and quality of life.
- knowledge, skills and abilities to work in a multicultural environment and in multidisciplinary medical and social teams;
- high personal and professional motivation and readiness for full professional realization

CURRICULUM CONTENT

LECTURES

Topic	hours
SECOND SEMESTER	
Social medicine as a science - subject, tasks, modern trends, methods. Social determinants of health and disease.	2
Sociology and Medicine. Comparative characteristics of the methods of collecting individual sociological information	2
Epidemiological methods in social medicine. Definition and scope of epidemiology. Basic concepts. Measuring the frequency of diseases	2
Types of epidemiological studies. Classification. Comparative characteristics of observational studies - advantages and disadvantages, potential errors.	2
Experimental epidemiological studies. Epidemiological studies and prevention. Levels of prevention. Strategies for primary prevention. Secondary prevention. Screening.	2
Public health - definition, data sources, key indicators, determinants of public health. Social inequalities in health. Morbidity - basic concepts, sources and methods of study.	2
Socially significant diseases. Morbidity trends in the world. Measuring the global burden of disease - DALYs. Global burden of chronic non-communicable diseases – cardiovascular, cancer, diabetes, etc.	2
Global burden and trends of Infectious Diseases. Global Burden of HIV/AIDS, Tuberculosis, Malaria.	1
THIRD SEMESTER	
Demographic indicators for population statics. Approaches to estimate the age structure of the population. Medico-social aspects of population aging.	2
Medico-social aspects of birth rate and total mortality. Global, regional and national trends.	2
Medico-social aspects of child mortality and average life expectancy - basic concepts. Global, regional and national trends.	2
The health system as a social system - fundamental goals and basic functions. Assessment of health systems performance. Typology of health systems. Health service.	2
Legislative foundations of health care in Bulgaria. Health legislation - essence, functions, principles. Constitutional foundations. Types of normative acts. Health law. Law on Health Insurance.	2
Law on medical facilities. Primary health care and hospital care.	2
Global issues of reproductive health and women's health. Global problems of children's health.	2
Health promotion - essence and development of the concept of health promotion. Health education.	1
Total:	**30**

EXERCISES

Topic	hours
SECOND SEMESTER	
Social factors of health. Socio-medical approach in the activity of the doctor. Structure and content of the social history of illness.	2
Public and group health. Family health as an example of group health. Medico-social characteristics of the family. Mechanisms of impact of the family environment on health	2
Sociological methods in health care. Sources and methods of collecting primary socio-medical information. The ESI questionnaire. Questionnaire method - essence and varieties	2
Technology for collecting primary sociological information. Sociological interview - essence, varieties and requirements for conducting.	2
Technology for collecting primary sociological information. Sociological observation. Documentary method.	2
TEST ON "MEDICAL SOCIOLOGY" SECTION	
Health epidemiology. Measuring the frequency of diseases - basic concepts /risk, population at risk, exposed persons, morbidity, morbidity, cumulative morbidity./.	2
Absolute and relative comparison of disease frequency - absolute risk, etiological fraction, population attributable risk, relative risk, odds ratio.	2
Types of epidemiological studies. Observational and experimental epidemiology. Characteristics of descriptive, ecological and cross-sectional studies - essence, advantages and disadvantages. Analysis of specific examples of the three types of epidemiological studies	2
Cohort epidemiologic studies and case-control studies - nature of the setting, types, features of the conduct, advantages and disadvantages. Potential errors in epidemiological studies - systematic errors, blurring.	2
Experimental epidemiological studies - classification, characteristics, advantages and disadvantages. Analysis of specific examples.	2
TEST ON "HEALTH EPIDEMIOLOGY" SECTION. Public Health. Morbidity as a measure of public health. Dynamics and structure of morbidity in Bulgaria. Morbidity with temporary disability - study methods, main indicators for evaluation. Enduring net mining capacity.	2
Socially significant diseases - criteria and trends. Major risk factors. WHO programs for the study and prevention of socially significant diseases.	2
TEST ON "MILDENCY Morbidity" SECTION	2
Health prevention - levels and scope. Basic strategies of primary prevention. Screening - essence, characteristics of screening tests.	2
Final lesson	2

THIRD SEMESTER

Demographic approaches to the study and evaluation of public health. Demographic indicators for population statics - number, structure by gender and place of residence. Age structure - assessment approaches, age pyramid. Medico-social consequences of the demographic aging of the population.	2
Demographic indicators for population dynamics. Fertility and fertility. Specific indicators of population growth. Obligations of the doctor when registering births	2
Demographic indicators for population dynamics. Analysis and evaluation of total mortality indicators. Structure and dynamics of total mortality. Obligations of the physician when registering deaths.	2
Demographic indicators for population dynamics. Analysis and assessment of child mortality indicators. Average life expectancy. - definition of the concepts, trends of the SPC in the world and in Bulgaria.	2
TEST ON "DEMOGRAPHICS" SECTION	2
Health system - definition, fundamental goals and functions. Health service - definition, factors of development, functions and principles of construction.	2
Health legislation. Law on health in the Republic of Bulgaria.	2
Basic provisions of the Health Insurance Act.	2
Basic provisions of the Law on Medical Facilities.	2
Organization of primary care for the population. Main goals, tasks and approaches in the work of the general practitioner with priority groups of the population. Obligations of the primary outpatient care physician according to the National Framework Agreement.	2
Organization of hospital care for the population. Types of medical facilities for hospital care. Indicators for evaluating the activity of the hospital.	2
Fundamentals of temporary disability expertise. Legal obligations of the bodies of expertise. General and specific requirements for issuing sick leave.	2
Health promotion - essence. Health education - principles, methods and forms. Assignment of a task to develop health-educational programs and materials	2
TEST ON SECTION "HEALTH SYSTEM AND HEALTH LEGISLATION". Presentation of the individual projects for health education materials and programs	2
Final lesson	2
Total:	**60**

EXAM QUESTIONNAIRE

I. FUNDAMENTAL PART

1. Social medicine as a science – definition and subject, development of concepts in social medicine, methods.

2. Health and disease - development of the concepts of health, definition and dimensions of health. Social factors of individual health. Essence of socio-medical approach. Social history of the disease.

3. Empirical sociological studies. Requirements for the questionnaire in the sociological survey. Survey method - essence, varieties, advantages and disadvantages. Sociometry.

4. Interview - essence, varieties, advantages and disadvantages. Sociological observation and documentary method - essence, varieties, advantages and disadvantages.

5. Epidemiological methods in social medicine. Definition and scope of epidemiology. Basic concepts. Measuring disease incidence. Disease, morbidity, cumulative morbidity.

6. Comparing the frequency of diseases. Essence of absolute and relative comparison and types of calculated indicators.

7. Types of epidemiological studies - classification. Observational epidemiology - descriptive studies, ecological studies, cross-sectional studies.

8. Cohort studies – definition, basic requirements, types of cohort studies – design, advantages and disadvantages.

9. Case-control studies – definition, design, basic requirements, advantages and disadvantages.

10. Experimental epidemiological studies - randomized clinical trials, field trials, population intervention trials.

11. Causality in epidemiology. Bradford Hill criterion for causality. Potential errors in epidemiological studies. Blurring.

12. Epidemiological studies and their role in preventive activities. Nature and types of prevention. Premorbid prophylaxis. Primary prevention - essence and comparative characteristics of strategies for primary prevention.

13. Secondary prevention - essence. Screening - definition, types, basic requirements for successful screening, evaluation of the validity of the screening test.

14. Public health - essence and definition. Measurement and evaluation of public health - core indicators. Sources and types of data for public health assessment.

15. Determinants of public health. Dahlgren and Whitehead's social model. Social inequalities in health and models to explain social inequalities.

16. Morbidity as a measure of public health - meaning, conditions, sources and methods of studying morbidity. Basic concepts in the study of morbidity. International Classification of Diseases /ICD/ - 10th revision.

17. Morbidity trends in the world. Socially significant diseases. Measuring the Global Burden of Disease - DALYs. Studies on the global burden of disease.

18. Global burden and trends of chronic non-communicable diseases (NCDs) and injuries - global health relevance, risk factors, WHO strategies to respond to NCDs.

19. Global Burden and Trends of Infectious Diseases - Relevance to Global Health. Global burden and trends of some infectious diseases - HIV/AIDS, tuberculosis, malaria.

20. Demographic processes and indicators. Demographic cycle. Indicators of population statics. Approaches to estimate the age structure of the population. Medico-social aspects of population aging.

21. Medico-social aspects of fertility - definition of the main concepts, evaluation scale. Population reproduction rates. Birth rate trends in the world and in Bulgaria.

22. Medico-social aspects of general mortality - definition of basic concepts, assessment scale, nature of standardized mortality indicators. Trends in total mortality in the world and in Bulgaria.

23. Medico-social problems of child mortality - definition of the main concepts, rating scale. Mortality up to 5 years of age. Trends in child mortality and under-5 mortality in the world and in Bulgaria.

24. Medico-social problems of the average life expectancy - definition of the main concepts. Trends of STDs in the world and in Bulgaria.

II. ORGANIZATIONAL-APPLICATION PART

25. International health cooperation. World Health Organization - purpose, principles, main tasks, structure. Other specialized organizations of the United Nations. Millennium Development Goals. United Nations Sustainable Development Goals (2015-2030).

26. WHO Global Strategy "Health for All" - essence and development. Strategy of the WHO European Region "Health for all in the 21st century". European Health 2020 policy framework. National Health Strategy 2020.

27. The health system as a social system - definition, fundamental goals and basic functions, evolution of health systems.

28. Health service - definition, characteristics and levels of health care. Factors, functions and organizational principles of the health service.

29. Health policy, health strategy and health management - definition of concepts, levels of health policy and health authorities. Priorities of health policy in developed countries.

30. Typology of health systems. Criteria and comparative characteristics of the health system models in developed countries.

31. Main guidelines of the health reform in Bulgaria - need for reform, goals and principles. Characteristic of the reform in medical activity.

32. General characteristics of health legislation in Bulgaria - Essence, functions and principles of health legislation. Legislative initiative and types of normative acts.

33. Basic provisions of the Health Act.

34. Basic provisions of the Health Insurance Act.

35. Basic provisions of the Law on Medical Institutions.

36. Primary health care - the WHO concept and the experience of developed countries. Primary health care in Bulgaria.

37. Hospital care. Hospital care needs. Types of hospital facilities, structure and functions of the hospital. Indicators for evaluating the activity of the hospital.

38. Global issues of reproductive health and women's health. The problem of maternal mortality. Organization of outpatient and hospital obstetrics and gynecology in Bulgaria.

39. Global problems of children's health. Organization of pediatric care in Bulgaria.

40. Medico-social problems of the elderly. Organization of health care for the elderly.

41. Basic provisions of the medical examination of working capacity. Basic concepts. Normative regulation and bodies of the expertise of working capacity - rights and obligations.

42. Basic and specific rules for issuing sick leaves for temporary incapacity for work.

43. Origin and evolution of the concept of health promotion. The contribution of the Ottawa Charter to the formulation of the basic principles of health promotion.

44. Health education - essence, main goals and principles, models and approaches, classic and modern methods of health education.

LITERATURE FOR PREPARATION

I. PRIMARY:

1. Lecture course in electronic form on Social Medicine – Professor Vladimir Gonchev, MD, PhD

2. Grancharova G., S. Aleksandrova-Yankulovska. Social medicine. Sixth revised and supplemented edition. ISBN 978-954-756-216-5. Publishing center of MU-Pleven, 2017, 2018, 326 pages.

3. Grancharova G., S. Aleksandrova-Yankulovska. Social medicine. Fifth revised and enlarged edition, ISBN 978-954-756-167-0. Publishing Center of MU-Pleven, 2018, 326 pages

4. R Bonita R Beaglehole T Kjellström Basic epidemiology WHO 2006

5. Rumen Stefanov Social medicine: training approaches and models, Plovdiv 2011

6. Health Law. Bulgarian legal portal - www.lex.bg

7. Health Insurance Law. Bulgarian legal portal - www.lex.bg

8. Law on medical institutions. Bulgarian legal portal - www.lex.bg

II. ADDITIONAL:

7. National Center for Public Health and Analysis. Brief statistical guide "Health" 2019. Available at: http://ncphp.government.bg

8. National Statistical Institute. Healthcare 2019. Available at http://nsi.bg/bg

9. Ministry of Health - www.mh.government.bg

10. National Health Insurance Fund - www.nhif.bg

11. World Health Organization. Health topics. http://www.who.int/topics/en/

Compiled the curriculum:

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(Professor Vladimir Gonchev, MD, PhD)

The curriculum was discussed and adopted at a meeting of the Department of Internal Medicine, Social Medicine, Disaster Medicine, Phisoterapy No. ..... of ..... d.

Head of Department: ..

(Professor Dr. Vladimir Gonchev)

The curriculum was adopted and discussed at the Faculty Council of the Faculty of Medicine, Protocol No. 30 from 15.02.2024г.

Faculty Secretary: ....

(Assistant Ruska Nenkova)