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ANNOTATION
work program of the academic discipline
"Physics mathematics"

Speciality	05/31/01 General medicine
Number of credits	In accordance with the RUP
Interim certification form (test/ exam)	test

The work program of the academic discipline "Physics, Mathematics" is compiled in accordance with the requirements of the Federal State Educational Standard of Higher Professional Education 31.05.01 General Medicine.

1. The purpose of studying the discipline

Targetmastering an academic discipline"**Physics mathematics**» consists of mastering knowledge about the physical properties and physical processes occurring in biological objects, including the human body; This knowledge is necessary both for teaching other academic disciplines and for the direct formation of professional medical qualities.

2. Summary of the discipline

1. Fundamentals of mathematical analysis of probability theory and mathematical statistics.
Derivatives and differentials. Integration rules. Calculation of indefinite and definite integrals. Methods for solving first order differential equations with separable variables.

Random event. Definition of probability (statistical and classical). Distribution of discrete and continuous random variables, their characteristics: mathematical expectation, dispersion, standard deviation. Normal and exponential law of distribution of continuous random variables. Distribution function. Probability density. Standard intervals.

Population and sample. Sample size, representativeness. Statistical distribution (variation series). Bar chart. Characteristics of position (mode, median, sample mean) and dispersion (sample variance and sample standard deviation). Estimation of the parameters of the general population based on the characteristics of its sample (point and interval). Confidence interval and confidence probability. Statistical testing of hypotheses. Comparison of means and variances of two normally distributed populations. Testing hypotheses about the laws of distribution of random variables.

2. Mechanics of liquids and gases. BiomechanicsAcoustics Live transfer processes systems. Bioelectrogenesis

Physical methods as an objective approach for studying patterns in living nature. The importance of physics for medicine. Mechanical waves. Plane wave equation. Parameters of oscillations and waves. Energy characteristics.

Doppler effect. Diffraction and interference of waves. Sound. Types of sounds. Complex tone and its acoustic spectrum. Wave resistance. Objective (physical) and subjective (psychophysiological) characteristics of sound. Weber-Fechner law.

Ultrasound, physical basis of application in medicine.

Physical foundations of hemodynamics. Viscosity. Methods for determining the viscosity of liquids. Stationary flow, laminar and turbulent flow. Newton's formula, Newtonian and non-Newtonian fluids. Poiseuille's formula. Reynolds number. Hydraulic resistance in series, parallel and combined tube systems. Branching vessels.

Hooke's law. Mechanical properties of biological tissues

Biological membranes and their physical properties. Transport of substances through biological membranes. Fick's equation. Nernst-Planck equation. Equilibrium transmembrane potential, Nernst equation. Stationary Goldman-Hodgkin-Katz potential. Resting potential. Action potential.

3. Electrical and magnetic properties of tissues and the environment

Electric dipole. Electric field of a dipole. Current dipole. Electric field of a current dipole in an unbounded conducting medium. Concept of a dipole electrical generator of the heart, brain and muscles. Einthoven's model. Genesis of electrocardiograms in three standard leads within the framework of this model.

Passive electrical properties of human body tissues. Equivalent electrical circuits of living tissues. Total resistance (impedance) in living tissues Dispersion of the impedance of body tissues. Physical processes occurring in body tissues under the influence of electric currents and electromagnetic fields.

4. Optics. Quantum physics, ionizing radiation

Geometric optics. The phenomenon of total internal reflection of light. Refractometry. Fiber optics. Optical system of the eye.

Microscopy. Resolution power of the microscope.

Wave optics. Electromagnetic waves. Electromagnetic wave scale. Interaction of light with matter. Absorption of light. Bouguer-Lambert-Baer law. Optical density.

Thermal radiation. Characteristics and laws of thermal radiation. Black body radiation spectrum. Physical basis of thermal imaging

Electronic energy levels of atoms and molecules. Luminescence. Stokes' law for photoluminescence. Luminescence spectra.

X-ray radiation. Interaction of X-ray radiation with matter. Physical basis of application in medicine.

Radioactivity. Law of radioactive decay.

Interaction of α-, β- and γ-radiation with matter. The mechanism of action of ionizing radiation on the human body.

Dosimetry of ionizing radiation. Absorbed, exposure and equivalent doses. Protection against ionizing radiation.