

**State budgetary educational institution of higher professional education  
"NORTH-OSSETIAN STATE MEDICAL ACADEMY"  
Ministry of Health Russian Federation**

**QUESTIONS TO MODULES**

**of educational discipline "Physics and mathematics"  
for Students 1 course of the 31.05.01 Medical case (specialty)**

**QUESTIONS TO MODULE 1**

1. Concept of derivative of function, its physical meaning.
2. Geometrical meaning of derivative.
3. General rule of differentiation of function. Formulas of differentiation.
4. Derivatives of elementary functions.
5. Differential of function. Properties of differential.
6. Rule of differentiation of composite function.
7. Primitive. Examples. The concept of the indefinite integral.
8. Table of integrals. The main properties of the indefinite integral.
9. The concept of the definite integral. The geometrical meaning.
10. The main properties of the definite integral.
11. Definition of a differential equation.
12. The order of the DE.
13. The linear differential equation.
14. Types of the solutions of the DE-s.
15. The DE of the first order with the separable variable and algorithm of its solution.
16. The main concepts of Probability Theory.
17. Definition of probability. Main theorems of probability theory.
18. Total probability formula.
19. Bernoulli and Poisson formulas.
20. Discrete random variables and their characteristics.
21. Continuous Random Variables. Distribution function and density function.
22. Numerical characteristics of Continuous random variables.

## QUESTIONS TO MODULE 2

1. Sound. Kinds of sounds.
2. Spectrum of sound. Wave resistance.
3. Objective (physical) characteristics of sound. Subjective characteristics, their relationship to the objective.
4. The Weber-Fechner law. Audiometry.
5. Ultrasound, physical principles of application in medicine.
6. Phenomena of the inverse piezoelectric effect and magnetostriction.
7. Doppler effect. Formula for determining the blood flow velocity.
8. Physical basis hemodynamics. Viscosity.
9. Methods for determining the viscosity of a liquid.
10. Stationary flow, laminar and turbulent flow. Reynolds number.
11. Newton's formula, Newtonian and non-Newtonian fluids.
12. The Poiseuille formula.
13. Laws of reflection and refraction of light.
14. Limiting angle of refraction and limiting angle of total internal reflection/
15. Phenomenon of total internal reflection.
16. Methods for determining the refractive index of liquids in transmitted and reflected light (draw the ray path in a refractometer in these cases).

### QUESTIONS TO MODULE 3

1. Full and useful magnification of the microscope. Beam path in a microscope. Aperture diaphragm and aperture angle.
2. Light absorption. Bouguer's law. Bouguer-Lambert-Beer law. Concentration colorimetry. Nephelometry.
3. Scattering of light. Tyndall's phenomenon. Molecular scattering, Rayleigh's law. Raman scattering.
4. Light is natural and polarized. Polarizer and analyzer. Law Malus.
5. Polarization of light with double refraction. Nicolas prism. Rotation of the plane of polarization. Bio's Law.
6. Thermal radiation. Heat radiation laws. Planck's formula.
7. Radiation of the Sun. Infrared and ultraviolet radiation and their application in medicine.
8. Heat transfer of the body. Physical foundations of thermography.
9. Luminescence, its types. Mechanism and properties of luminescence. The rule Stokes.
10. Application of phosphors and luminescence analysis in medicine.
11. Forced radiation. Inverse population of levels. The main laser elements.
12. Design and principle of operation of ruby and helium-neon lasers.
13. Properties of laser radiation. Application of laser radiation in medicine.
14. X-ray radiation. X-ray tube device. Brake X-ray radiation.
15. Characteristic X-ray radiation. Moseley's Law.
16. Primary processes of interaction of X-ray radiation with substance: coherent scattering, Compton effect, photoelectric effect.
17. X-ray diagnostics. Fluoroscopy and radiography. Modern X-ray computed tomographs.
18. The phenomenon of radioactivity. Types of radioactive decay. The basic Law radioactive decay.
19. Alpha-decay of nuclei and its features. Beta decay of nuclei, its types, features and spectrum. Gamma radiation from nuclei.
20. Interaction of ionizing radiation with matter.
21. Dosimetry of ionizing radiation. Absorbed and exposure dose. Dose rate.

22. Quantitative assessment of the biological effect of ionizing radiation. Radiation quality factor. Equivalent dose.

23. The primary effect of ionizing radiation on the body. Defence from ionizing radiation.

24. Radiation sickness, its types. Periods and symptoms of acute radiation sickness.