



EXAMINATION PAPER № 01

Course: Optical methods in biology and medicine
Department of Industrial and Medical Electronics
Year of study: **the 2nd year master study**

1. Modern fiber consists of at least two components: the core and the shell. Which of these parts has a larger refractive index and why? (10 points)
2. What is the divergence of laser radiation? (15 points)
3. Explain the conditions for the existence of continuous generation. (15 points)

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EXAMINATION PAPER № 03

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1. Modes in optical fiber. How to make fiber single-mode?. (10 points)
2. Efficiency of He-Ne laser. At what wavelength, 0.63 or 3.39 μm is laser efficiency higher? (15 points)
3. Please, name the basic parts of compound microscope. (15 points)

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EXAMINATION PAPER № 02

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1. What are the main causes of signal attenuation when transmitting over fiber? (10 points)
2. How is the minimum divergence of the radiation beam limited? (15 points)
3. How does the wavelength of the radiation effect on the skin? (15 points)

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EXAMINATION PAPER № 04

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1. Is it possible and why to transmit one fiber at the same time at the same time several signals? (10 points)
2. How to reduce the divergence of laser radiation? Can we make it null? (15 points)
3. Stimulated emission depletion microscopy. (15 points)

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EXAMINATION PAPER № 05

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1. How is the inversion population in of He-Ne laser created? (10 points).
2. Methods of microscopy, which use scanning principle. (15 points)
3. Specify the photothermal effects and corresponded temperatures for them. (15 points)

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EXAMINATION PAPER № 07

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1. What are the heat transfer mechanisms? (10 points)
2. Classification of lasers with respect to medical applications. (15 points)
3. Classification of devices for endoscopic diagnostics. (15 points)

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EXAMINATION PAPER № 06

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1. To increase the capacity of an optical channel, multiplexing of data transmission channels is used. How is this realized? (10 points)
2. What properties should have an active medium for use in active optical systems with brightness amplification? (15 points)
3. Enumerate the methods for visual diagnostics. (15 points)

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EXAMINATION PAPER № 08

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1. What tasks does optical fiber use? (10 points)
2. What is the similarity and difference between the concepts of "laser projection microscope" and "laser monitor"? (15 points)
3. Optical coherence tomography. (15 points)

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EXAMINATION PAPER № 09

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1. Define the three main types of fiber. (10 points)
2. What methods of measuring divergence do you know? (10 points)
3. Diffuse optical tomography. (20 points)

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EXAMINATION PAPER № 10

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1. At what distance from the radiation source should be measured beam divergence? (10 points)
2. What are the main precautions to avoid injuries by laser radiation? (15 points)
3. Confocal microscopy. (15 points)

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EXAMINATION PAPER № 11

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1. Explain the merits and demerits of single-mode fiber optics. (10 points)
2. Explain the concepts of Fresnel diffraction and Fraunhofer diffraction. (15 points)
3. Please, name the basic parts of compound microscope and its designation (15 points)

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EXAMINATION PAPER № 12

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Year of study: **the 2nd year master study**

1. How is the upper working level of He-Ne laser mixture pumped? (10 points)
2. Explain the total internal reflection. (15 points)
3. Please draw the ray path in a microscope. (15 points)

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EXAMINATION PAPER № 13

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1. Point the difference between flame, UV, IR and Raman Spectroscopy. (10 points)
2. When choosing the method of research we ask three main questions. What are they? (15 points)
3. Explain how refracted angle depends on values of n_2 and n_1 . (15 points)

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EXAMINATION PAPER № 15

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1. Total internal reflection. (10 points)
2. Principle of operation of He-Ne laser. (15 points)
3. Principles of high-definition diffuse optical tomography. (15 points)

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EXAMINATION PAPER № 14

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Year of study: **the 2nd year master study**

1. Characterize the processes: diffuse surface, specular reflections, intrabeam exposure. (10 points)
2. UV spectroscopy. (15 points)
7. CW lasers. Principle of operation. (15 points)

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EXAMINATION PAPER № 16

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1. The rules of eye components. (10 points)
2. IR (infrared) spectroscopy. (15 points)
3. XeCl excilamp. Principle of operation. Applications. (15 points)

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EXAMINATION PAPER № 17

Course: Optical methods in biology and medicine
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Year of study: **the 1nd year master study**

1. The rules of skin components. (10 points)
2. Confocal microscopy. (15 points)
3. Explain the term of "superradiance". (15 points)

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EXAMINATION PAPER № 19

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Year of study: **the 2nd year master study**

1. What should be the spectral distribution of background radiation, so that monitoring with a CuBr laser monitor becomes difficult? (10 points)
2. Physiological window of absorption. (15 points)
3. What is the difference between fiberscope and video scope? (15 points)

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EXAMINATION PAPER № 18

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1. Enumerate the methods for visual diagnostics. (10 points)
2. The principle of operation and the method of creating an inversion in the Nd:YAG laser. (15 points)
3. Characterize the wavelength region for photodynamic therapy. (15 points)

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EXAMINATION PAPER № 20

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1. Please draw the ray path in a microscope. (10 points)
2. What is the second harmonic generation effect used for. (15 points)
3. Characterize the effect of radiation on the skin depending on the intensity and dose. (15 points)

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