COURSE DESCRIPTION SYLLABUS

1. Name of course: “Optical Methods in Biology and Medicine”

2. Notation (code) in curricula: ДИСЦ.В.М.1.2.

3. Field (primary curriculum): 12.04.04 Biotechnical systems and technologies

4. Training profile: Biomedical engineering

5. Qualification (degree): Master

6. Supporting subdivision: Department of Industrial and Medical Electronics, Institute of Non-Destructive Testing, TPU

7. Lecturer: Associate Professor Fedor Alexandrovich Gubarev, tel. +7(913) 880-8005, *E-mail:* gubarevfa@tpu.ru

8. Learning outcomes:

№	Result
CLO 1 (РД1)	To provide search, analysis of scientific and technical information according to the subject of the study, use the achievements of science, engineering and technology
CLO 2 (РД2)	To perform calculations and design of optical medical systems for diagnostics and therapy.
CLO 3 (РД3)	Perform setup, repair and verification of laser and light equipment for medical and biological research.

9. The course outline:

Theory

Section 1. Optical methods of research

1.1. Fundamental optical properties of objects.

1.2. The penetration of radiation into biological tissue. Interaction of coherent and incoherent radiation with biological objects.

1.3. Optical methods for studying biological tissues and bioliquids.

1.4. Sources of radiation.

1.5. Passive optical systems components.

1.6. Radiation detectors.

1.7. Methods for measuring optical parameters of biological tissues.

Section 2. Physics and technology of lasers for medicine

2.1. Objects laser exposure.

2.2. Generalized scheme of medical laser systems. Safety when working with laser installations.

2.3. Classification of lasers with respect to medical applications.

2.4. Physical basis of laser technology.
2.5. Laser Surgery.
Section 3: Incoherent radiation sources for medical.
3.1. Light-emitting diodes used in medical equipment.
2.2. Excilamps for biology.

Practice

1. The calculation of the radiation power incident on the object at the given values of the beam divergence and atmospheric attenuation coefficient on the track of a given length.
2. The calculation of the radiation dose to the low-intensity therapy.
3. Calculation of the laser efficiency.
4. Measuring the divergence of the laser radiation.
5. Calculation of the emission wavelengths of the harmonics of higher orders for lasers.

Labs

Lab No 1. Laser Safety Fundamentals. The study principle and parameters of radiation helium-neon laser.

Lab No 2. The study principle and parameters of the radiation solid-state laser diode pumped.

Lab No 3. Passage of radiation over fiber. The use of fiber optics for diagnosis and therapy.

Lab No 4. Visualization image biological object with a laser display.

Lab No 5. Analysis of the solutions by the optical transmission/absorption.

Lab No 6. Visualization and reading ripple the surface of the arteries by recording laser speckle fields.

Lab No 7. Studying the effects of UV radiation on biological object excilamp.

10. Year: 2, semester: 3, number of credits: 3.

11. Prerequisites:
ДИСЦ.В.М5 "Interaction of physical fields with biological object",
ДИСЦ.В.М3 "Biotechnical Systems and Technologies",
ДИСЦ.Б.М2 "Biophysical fundamentals of living systems".

12. Corequisites:
ДИСЦ.В.М.1.1 "Biomedical sensors and signals"

13. Type of attestation: exam

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