LIST OF ENTRANCE EXAM QUESTIONS

FOR THE INTERNATIONAL MASTER'S DEGREE PROGRAM

ITMO

PHYSICS AND TECHNOLOGY OF NANOSTRUCTURES

1. Electromagnetic field. Physical essence of Maxwell's equations.
2. Field energy of an electromagnetic wave. Poynting vector
3. Basic photometric, and their measurement units.
4. Coherence of light. Interference of waves. Spatial coherence.
5. Interference devices and the use of interference.
6. Diffraction of light. The Huygens–Fresnel principle.
7. Fraunhofer diffraction. Diffraction grating.
8. Holography. A hologram as an element of an ideal optical system. Application of holography.
9. 3D image holograms (Denisyuk's method). Color holographic images.
10. The basics of geometric optics. The Fermat's principle. Thin lens.
11. Aperture diaphragm, entrance and exit pupils. Spectral equipment.
12. The optical resolution of the lens and microscope. Principles of electron microscopy.
13. The transverse wave of light. Light propagation through tourmaline.
14. Malus' Law. Natural light.
15. Detection and analysis of elliptically circularly polarized light.
16. X-ray spectrography.
17. Doppler effect in optics.
18. Reflection and refraction of an electromagnetic wave at the dielectric. Fresnel equations. Brewster's law.
19. Total internal reflection. Elliptical polarization.
20. Characteristics of the optical properties of the metal.
21. Dispersion and absorption of light. The width of the spectral lines.
22. Light scattering. Molecular scattering.
23. Optical rotation. Optical activity.
24. The Zeeman effect. Anomalous Zeeman effect.
25. Photoelectric effect. Internal photo effect. Solar cells.
26. Atomic models. Bohr's postulates. Resonant radiation. Linear spectra.
27. Photoluminescence. Stokes' law. Duration of photoluminescence.
28. The principle of laser operation.
29. Nonlinear dispersion. Sum-frequency and difference-frequency generation.
30. Stimulated Raman scattering.

RECOMMENDED LITERATURE

1. Elementary textbook of physics. Oscillations and Waves Optics Atomic and Nuclear Physics. Volume 3. Edited by G.S. Landsberg: https://archive.org/details/LandsbergElementaryTextbookOnPhysicsVol3Mir1989/page/n13/mode/2up
2. Рекомендуемый онлайн курс: Nanotechnology: A Maker's Course | Coursera — https://coursera.org/learn/nanotechnology