



1. The nature of light. Electromagnetic spectrum. Optical phenomena at the interface of media.
2. The concept of an ideal optical system and its main characteristics. Limitations of light beams.
3. The main parameters of radiation sources and receivers: energy parameters, spectral, spatial, electrical parameters, noise and threshold characteristics.
4. Basic concepts of geometric optics. Basic laws and invariants. Fresnel formulas.
5. Natural and artificial light sources. Their parameters and characteristics.
6. The band structure and the main characteristics of semiconductors. Types of conductivity in semiconductors.
7. The operation principles, the switching circuit, the main parameters and characteristics of semiconductor emitting diodes (LEDs, laser diodes).
8. Laser's classification. The main elements and their purpose. Parameters and characteristics. The main advantages of laser radiation and its possibilities.
9. Optical signal, its transformation and types. Continuous and discrete Fourier transform.
10. Optical methods and systems of information transmission and processing.
11. The concept of color. Color as an object of color measurements. Color's characteristics. The eye as an organ of color perception. Three-component theory of color vision.
12. The Raman effect. Raman spectroscopy.
13. Contact and non-contact methods of temperature measurements.
14. Nanomaterials: definition and examples. Their differences from traditional materials.
15. Structural and functional materials, differences between them.
16. Defects in crystals: classification and characteristics, influence of the defects on the physical and mechanical properties of the crystal.
17. The main types of optical materials and features of their application in photonics.
18. Crystallography and the concept of symmetry of crystallographic lattices.
19. The influence of crystal syngony type on optical and other physical properties of optical crystals.
20. Methods of crystal growth. The specifics of the technology for obtaining optical and semiconductor crystals.
21. The main groups of optical glasses according to their classification by optical properties and chemical composition. The specifics of the physico-chemical properties of each group of glasses, their chemical composition, structure.
22. Electronic structure of dielectrics. The most important dielectric characteristics: dielectric susceptibility/permeability, dielectric losses, electrical breakdown.
23. Information, basic terms and definitions, phases of information circulation.
24. Modern wireless information transmission transfer systems.
25. Basic concepts and laws of the theory of electrical circuits. Passive and active elements. Ohm's Law, Kirchoff's Law.
26. Periodic and harmonic currents and voltages. The laws of Ohm and Kirchoff in a complex form. Vector diagram.
27. Equivalent sections of the circuit with serial and parallel connection. Equivalence of current and voltage sources.
28. The method of contour currents, the method of nodal voltages, the method of superposition. Theorems about an equivalent current and voltage generator.
29. Voltage resonance and current resonance. The input resistance of the circuit at resonance and in the region of small detunements. Reduced Q-factor.
30. Indicators and characteristics of analog electronic devices.

## EXAM PREPARATION MATERIALS

1. Sze S. M., Li Y., Ng K. K. Physics of semiconductor devices. – John Wiley & sons. – 2021.
2. Horowitz, P., Hill, W., & Robinson, I. (1989). The art of electronics. Cambridge: Cambridge university press.
3. Mitschke, Fedor, and Fedor Mitschke. Fiber optics. Springer Berlin Heidelberg, 2016.
4. Jack G. Ganssle. The art of designing embedded systems. Butterworth-Heinemann, 2000.