The main lecture courses

1. Interference and diffraction of light and their use.

The program includes the theory of interference of light, coherence's theory, diffraction's theory, practical use of interference and diffraction including optical holography.

2. Spectroscopy of atoms and molecules.

The aim of this course is to familiarize students with basics of the theory of atomic and molecular spectroscopy, basic atoms and molecules spectrum types. This course is a theoretical basis for the following courses: "Practical spectroscopy", "Luminescence", "Laser physics" and others.

3. Practical spectroscopy

The modes of functioning and general properties of optical spectral instruments including instruments of high resolution are included in the course. Optical light sources, radiation filtration, light detection methods as well as modern laser spectroscopy are part of the course.

4. Crystal optics

The course teaches regularities and phenomena, which accompany propagation of light in anisotropic media. All explanations are based on Maksvell equations. The optical properties are associated with the symmetry of crystals grate. The methods of production and analysis of the polarized light, induced anisotropy effect and optical activity are discussed in the course of studies.

5. Solid spectroscopy

The lecture course includes the solid spectra theory, methods of their investigation based on the theory of oscillations, quantum mechanics and the theory of groups. It also teaches the basics of phonon and electron spectrum of crystals, physics of exciton in semiconductor and dielectrics. Experimental methods of determination of crystal optical properties are provided.

6. Luminiscence and nonequilibrium electron processes in solids

The special course of study is the continuation of the course "Solid spectroscopy". It explains the general types of luminescence and provides their characteristics. The influence of different factors on quenching and kinetics of photoluminescence (Plm) is studied during the course as well as the influence of impurities on Plm spectra in crystals, photoconduction and Plm in semiconductor materials, modes of operation of semiconductor instruments, crystal phosphorescence. The importance of studying Plm radiation for the development of laser is stressed in the course.

7. Laser physics

The light amplification principle, generation conditions, optical cavity theory, laser action spectra, spatial characteristics of laser emission, continuous and impulse generation, different laser type are discussed.

8. General of nonlinear optics

General phenomena in the media with quadratic and cubic polarization are stated. They are described with the help of three and four-wave interaction. Various phenomena of light self-action on the matter (self-focusing, optical solitons and other), practical application in nonlinear spectroscopy and generation harmonic are studied.

9. Thin films optics

The optical characteristics of one and multi-layer coatings, methods of calculating their spectral and angular dependence, multilayer coatings synthesis and optical constant measurements using different methods are discussed.

10. Basics of luminescence

The basics of radiation theory are discussed. The luminescent power of atoms, energetic and quantum efficiency, kinetics, Stokes and ant-Stokes luminescence, fluorescence and phosphorescence, thermoluminescence, interaction between absorption, excitation spectra and luminescence, luminescence polarization are stated.

11. Introduction into optoelectronics

The basics of optoelectronics, regularities of light propagation in planar and fiber waveguides, sources and detectors of radiation in optoelectronics, fiber-optical sensors, input and output radiation devices are considered.

12. Optical methods of information science

The optical methods of information circulation and processing, data amount measurement, diffraction, Fourier and Rezel transformation, optical image processing, spatial and temporal coherence, holographic techniques for registration information, materials for optical information processing are dealt with.