Discipline Description

1	Discipline	Introduction to solid state physics
2	Year of Study, Speciality Specializations	4; 1-31 04 01 Physics (Physicist. Researcher); 1-31 04 01-01 02 Solid-state physics; 1-31 04 01-01 07 Energy physics;
3	Term of Study	5
4	Number of Credits	1.5
5	Tutors	Professor, Doctor of Physics, A. Fedotov
6	Study Objectives	To demonstrate to students the fundamental ideas and principles of condensed matter physics (chemical bonds, atomic structure, zone model, main properties)
7	Prerequisites	Fundamentals of general physics and mathematics, quantum mechanics, thermal dynamics, statistical physics,
8	Course Content	Chemical bonds. Atomic structure. The reciprocal space. Brillouin zone. Atomic oscillations in one-dimensional chain. Acoustic and optical oscillations. Concept of phonons. The phonon spectrum. Heat capacity of lattice: classical, Einstein and Debye approaches. Anharmonicity of atomic oscillations. Thermal expansion. Phonon heat conductivity. Defects of crystalline lattice and their classification. Mechanical properties of solids. Atomic diffusion in solids. Drude model for free electron gas. Boltzmann kinetic equation. Quantum theory of free electrons in metals (Zommerfeld model). Zone model of solids. Single-electron and adiabatic approximations. Bloch wave-function. Solution of the stationary Schrödinger equation for the Kronig-Penney model. Electron dynamics in periodic lattice. Concept of effective mass. Electrical conductivity of intrinsic and doped semiconductors. Hydrogen-like dopants. Mechanisms of charge carriers' scattering. Statistics of charge carriers in semiconductors. Experimental determination of concentration and mobility of charge carriers. Electronic properties of disordered media. Electronic properties of nanostructured objects. Quantum confinement effects. Properties of crystalline dielectrics. Magnetic properties of solids. Superconductivity.
9	Literature Recommended	A.K. Fedotov. Energy effective materials. https://dl.bsu.by/pluginfile.php/76002/mod_resource/content/1/EnergyEffectiveMaterialsTEMPUSEng.pdf
10	Methods of Teaching	Lecture courses using modern teaching methods, information and communication technologies, methods of analysis and synthesis
11	Language of Teaching	English
12	Requirements, Current Assessment	Written tests, tests, seminars
13	Form of Current Assessment	Exam