

**PHYSICAL FOUNDATIONS OF NANOTECHNOLOGIES. HIGH-ENERGY METHODS OF
INFLUENCE ON MATERIALS**

(name of the discipline)

ANNOTATION

TO THE CURRICULUM OF THE INSTITUTION OF HIGHER EDUCATION

for the specialty 7-06-0714-02-3 Innovative technologies in mechanical engineering

profiling Mechanical engineering and machine science; Transport, mining and construction engineering; Welding technologies.

	Form of higher education	
	Full-time (daytime)	correspondence
Well	1	1
Semester	1	1
Lectures, hours	34	8
Laboratory lessons, hours	34	8
Report, semester	1	1
Classroom hours per academic discipline	68	16
Independent work, hours	40	92
Total hours per academic discipline / credits	108/3	

1. Brief content of the discipline

The purpose of studying the discipline is to form students' systematized knowledge, practical skills and abilities in the field of nano- and optoelectronics technologies, as well as to form students' fundamental physical knowledge necessary for specialists working in the field of nanotechnology. The purpose of the discipline is to familiarize undergraduates with modern methods for modifying the structural-phase state and properties of surface layers of materials under the influence of concentrated particle flows, including photons, electrons and ions.

2. Learning outcomes

As a result of studying the discipline, students should: **know:** – basic physical phenomena and processes that determine the structural, electrical and optical characteristics of nanoscale structures;– principles of self-ordered formation of low-dimensional structures and methods of self-organization in the formation of nanostructures and devices based on them. – principles and promising technologies for constructing systems based on low-dimensional effects; - theoretical foundations of processes occurring in solids under the influence of concentrated particle flows; - the main methods of modification of solids by concentrated particle flows, their technological application; - advantages and disadvantages of modification methods;

be able to: - analyze the physical processes occurring in low-dimensional structures during basic technological operations. – correctly choose the necessary processes suitable for the formation of elements and devices of nanoelectronics, optics and radiophysical devices; – to optimize the technological processes of formation of nanosized structures, including their self-organization; - calculate the main parameters of exposure (such as ion range, spray coefficient, surface temperature, etc.); - correctly choose the method of modification of properties for solving scientific and technological problems; - work independently and improve your professional level; - to implement an integrated approach to solving problems in the field of materials science; - apply basic scientific and technical knowledge to solve scientific and applied problems in the field of reactor materials science;

have the skill: - methods of experimental measurements, theoretical calculations and computer simulation of technological operations of self-organized assembly of nanostructures. - basic principles for predicting changes in the structural-phase state of solids when exposed to concentrated particle flows; - be able to apply basic scientific and technical knowledge to solve scientific and applied problems in the field of condensed matter physics; - use computer methods for collecting, storing and processing information, scientific, technical and patent literature; - search, systematize and analyze information on promising areas of industry development, innovative technologies and projects; - organize your own work and interaction with other performers.

3. Formed competencies:

Mastering this academic discipline should ensure the formation of the following competencies:

UK-2 Solve research and innovation tasks based on the use of information and communication technologies

UK-4 Provide communication, demonstrate leadership skills, be capable of team building and development of strategic goals and objectives

UK-5 Develop innovative receptivity and ability to innovate

UK-6 Be able to predict the conditions for the implementation of professional activities and solve professional problems in conditions of uncertainty

UPK-3 Use knowledge about the physical foundations of nanotechnology and concentrated energy flows, new materials and the prospects for their development in the design of highly efficient technological processors for the manufacture of machine parts

UPK-4 Apply information about theoretical principles, methods and tools for research and testing of working machines when creating new and upgrading existing machines

4. Requirements and forms of current and intermediate certification

Current and intermediate certification is carried out in written and oral-written form through reports on practical work with their oral defense, written test.

