

## CATALOG OF ELECTIVE DISCIPLINES

**7M01 - Pedagogical sciences**

(Code and classification of the field of education)

**7M015 - Training of teachers in Natural science subjects**

(Code and classification of the direction of training)

**0114**

(Code in the International Standard Classification of Education)

**M011 - Training of physics teachers (kazakh, russian, english language)**

(Code and classification of the educational program group)

**7M01502 - Physics**

(Code and name of the educational program)

**Master**

(Level of preparation)

**set of 2024**

## **Developed**

Developed

By the Academic Committee of the EP

Head of AC Ospanova D.M.

EP Manager Zheldybayeva B.S.

## **Reviewed**

At a meeting of the Academic Quality Commission of the Faculty

Protocol No3 "09" \_01\_ 2024

At a meeting of the Academic Quality Commission

of the Higher School of Physical and Mathematical Sciences

Recommended for approval by the Academic Council of the University

Protocol No.1 «06» june 2024

## **Approved**

at a meeting of the University Academic Council by protocol No. 3 of January 16, 2024.

at a meeting of the University Academic Council by protocol No. 6 of June 18, 2024.

## Study of crystal modification issues

Discipline cycle	Basic disciplines
Course	1
Credits count	5
Knowledge control form	Examination

### Short description of discipline

*The course considers some issues of modification of crystalline solids, the structure and symmetry of solids. Considers in detail the bonds between atoms, the types of bonds: hydrogen, covalent, molecular, Van der Waals, ionic. The main types of bonds in condensed solids. Amorphous substances, conditions for the transition of crystalline bodies into amorphous. Application of crystals in solid state physics, science and technology.*

### Purpose of studying of the discipline

*Demonstrates basic knowledge in the analysis of crystal modification issues.*

### Learning Outcomes

*ON1 Apply fundamental scientific, pedagogical, managerial, communicative knowledge and skills in professional activities.*

*ON3 Carry out independent scientific research in the field of educational psychology, methods of teaching physics*

*ON4 Demonstrate the developmental knowledge and understanding gained at the higher education level that is the basis of original development*

### Learning outcomes by discipline

*be competent:*

*in the basic physical phenomena, their manifestations in nature and application in technology, their mathematical description; in basic measuring instruments, in solving specific problems of physics and their correlation with the general laws of physics.*

*ON 1 Apply fundamental scientific, pedagogical, managerial, communicative knowledge and skills in professional activities.*

*ON3 Carry out independent scientific research in the field of educational psychology, methods of teaching physics*

*ON4 Demonstrate the developmental knowledge and understanding gained at the higher education level that is the basis of original development*

### Prerequisites

*Bachelor*

### Postrequisites

*Equilibrium properties of substances Heat engines and their applications Thermodynamic phenomena in animate and inanimate nature*

## Using elements of folk pedagogy in physics at secondary school

Discipline cycle	Basic disciplines
Course	1
Credits count	5
Knowledge control form	Examination

### Short description of discipline

*The integration of folk pedagogy, ethnopedagogy, visual materials, tasks, examples, texts from collections of Kazakh poets and writers in each topic of many chapters of physics teaches students to form a worldview, study the meaning and meaning, understand the physical meaning of theoretical knowledge, master a wide range of topics and continuous physical phenomena. Hence the formation of students' knowledge on the basis of folk pedagogy.*

### Purpose of studying of the discipline

*Demonstrates basic knowledge of general physics course with elements of folk pedagogy*

### Learning Outcomes

*ON3 Carry out independent scientific research in the field of educational psychology, methods of teaching physics*

*ON6 Compare traditional and innovative educational methods and technologies for teaching physics to organize an effective educational process.*

*ON7 Organize the cognitive activity of students, apply the basics of the methodology of the educational process in physics in their activities.*

### Learning outcomes by discipline

*As a result of studying the subject, the graduate should know: folk pedagogic tools - proverbs, riddles, fairy tales, poems, arguments, legends, heroes' songs, national games, sagas, etc. effectively using the main problems, examples, the features of their physical meaning, the main concepts, quantities, the basis of methods and processing of the true appearance of phenomena.*

*should be able to understand:*

*basic physical concepts using the elements of folk pedagogy, their observation in nature and their use in technology;*

*must be able to:*

*realizing the goals of education, development, upbringing, working on the basis of being able to connect one's own attitude to life, various social opinions in one's environment, national values in one's mind, being able to improve the meaning of physics, solve problems using the elements of folk pedagogy and connect it with the laws of physics to know;*

### Prerequisites

*Bachelor*

### Postrequisites

*Actual problems of modern physics Modern methods of teaching general physics course*

## Methods of teaching physics with elements of folk pedagogy

Discipline cycle	Basic disciplines
Course	1
Credits count	5
Knowledge control form	Examination

### Short description of discipline

It is planned to consider the preparation of theoretical and practical courses of folk pedagogy and general physics, the foundations of modern forms and types, the relationship between the content of the physics course and the content of other disciplines. The methodological basis for mastering the elements of folk pedagogy in the preparation of future specialists is the highest level of a unified system of physical education, therefore, it is formed in continuity with the general course of physics.

### **Purpose of studying of the discipline**

- mastering the methodology of teaching physics using elements of folk pedagogy; The subject "Methods of teaching physics using elements of folk pedagogy" is of great importance in the training of future specialists and school teachers.

- in a special course draws the attention of undergraduates to the most general concepts, laws and principles of physics, allows them to discuss and implement physical processes and phenomena;

- the methodological basis of physics plays a key role in the formation of a unified view of undergraduates on the modern physical picture of the world;

- The methodological basis for mastering the elements of folk pedagogy is the highest level of a unified system of physical education, special for physics, so it is necessary to continue the course of general physics.

### **Learning Outcomes**

ON3 Carry out independent scientific research in the field of educational psychology, methods of teaching physics

ON6 Compare traditional and innovative educational methods and technologies for teaching physics to organize an effective educational process.

ON7 Organize the cognitive activity of students, apply the basics of the methodology of the educational process in physics in their activities.

### **Learning outcomes by discipline**

As a result of studying the subject, the graduate should know: folk pedagogic tools - proverbs, riddles, fairy tales, poems, arguments, legends, heroes' songs, national games, sagas, etc. effectively using the main problems, examples, the features of their physical meaning, the main concepts, quantities, the basis of methods and processing of the true appearance of phenomena.

should be able to understand:

basic physical concepts using the elements of folk pedagogy, their observation in nature and their use in technology;

must be able to:

realizing the goals of education, development, upbringing, working on the basis of being able to connect one's own attitude to life, various social opinions in one's environment, national values in one's mind, being able to improve the meaning of physics, solve problems using the elements of folk pedagogy and connect it with the laws of physics to know;

ON3 Carry out independent scientific research in the field of educational psychology, methods of teaching physics

ON6 Compare traditional and innovative educational methods and technologies for teaching physics to organize an effective educational process

ON7 Organize the cognitive activity of students, apply the basics of the methodology of the educational process in physics in their activities

### **Prerequisites**

Bachelor

### **Postrequisites**

Actual problems of modern physics Modern methods of teaching general physics course

## **Modification of crystals in solid state physics**

Discipline cycle	Basic disciplines
Course	1
Credits count	5
Knowledge control form	Examination

### **Short description of discipline**

The course examines the properties of crystalline solids, their modifications, structure and symmetry of solids. The structure of condensed solids and methods for their study. bonding of atoms to each other. The main types of bonds in condensed solids. Amorphous substances. Application of crystals in solid state physics, science and technology.

### **Purpose of studying of the discipline**

Demonstrates base knowledges in area of analysis of questions of modifying crystals.

### **Learning Outcomes**

ON1 Apply fundamental scientific, pedagogical, managerial, communicative knowledge and skills in professional activities.

ON3 Carry out independent scientific research in the field of educational psychology, methods of teaching physics

ON4 Demonstrate the developmental knowledge and understanding gained at the higher education level that is the basis of original development

### **Learning outcomes by discipline**

to be competent:

in basic physical phenomena, their manifestations in nature and their use in technology, their mathematical description; in basic measuring instruments, in solving specific problems of physics and their connection with the general laws of physics.

### **Prerequisites**

Basic and profile disciplines of the EP

### **Postrequisites**

Equilibrium properties of substances Heat engines and their applications Thermodynamic phenomena in animate and inanimate nature

## **Classical and quantum theory of motion of charged particles and radiation**

Discipline cycle	Basic disciplines
Course	1
Credits count	5
Knowledge control form	Examination

### **Short description of discipline**

The motion of particles in crossed electric and magnetic fields is considered. In the school physics course there is the concept of the

speed of light, so this section is related to this concept. Along with this, the radiation power of particles is considered. The school course has a section on electric current, so this section contains an electric current in the relativistic approximation. This problem is considered in various electric and magnetic fields. For example, in a uniform magnetic field and an inhomogeneous electric field.

### **Purpose of studying of the discipline**

#### **Learning Outcomes**

ON1 Apply fundamental scientific, pedagogical, managerial, communicative knowledge and skills in professional activities.

ON3 Carry out independent scientific research in the field of educational psychology, methods of teaching physics

ON4 Demonstrate the developmental knowledge and understanding gained at the higher education level that is the basis of original development

#### **Learning outcomes by discipline**

#### **Prerequisites**

#### **Postrequisites**

## **Relativistic quantum theory of particle motion and radiation**

Discipline cycle	Basic disciplines
Course	1
Credits count	5
Knowledge control form	Examination

#### **Short description of discipline**

According to the relativistic quantum theory, motions, radiations of charged particles in electric, magnetic fields considered, electric current that occurs in various fields. The radiation intensity is found according to the quantum theory. The relativistic motion of an electron in a homogeneous magnetic, inhomogeneous electric field (taking into account spin), the Dirac equation for an electron in crossed electromagnetic fields are considered.

#### **Purpose of studying of the discipline**

- training of specialists capable of solving theoretical and multifaceted practical problems arising in various scientific fields;
- the special course will draw the attention of undergraduates to the most general concepts, laws and principles of physics, teach them to discuss and implement physical processes and phenomena;
- theoretical physics plays a key role in the formation of a holistic attitude of undergraduates to the modern physical picture of the world;
- theoretical physics is the highest level of a unified system of special physical knowledge, therefore continuity with the course of general physics is required.

#### **Learning Outcomes**

ON1 Apply fundamental scientific, pedagogical, managerial, communicative knowledge and skills in professional activities.

ON3 Carry out independent scientific research in the field of educational psychology, methods of teaching physics

ON4 Demonstrate the developmental knowledge and understanding gained at the higher education level that is the basis of original development

#### **Learning outcomes by discipline**

As a result of studying the discipline, the undergraduate must:  
know:

▣ fundamental laws of quantum theory;

be able to:

- explain the fundamental concepts of theoretical physics;

have skills:

- understanding of the limits of applicability of relativistic theories;

- Skills in working with scientific literature

- the general structure of theoretical physics;

be competent:

-correct use of modern ideas in solving physical problems

ON 1 Apply fundamental scientific, pedagogical, managerial, communicative knowledge and skills in professional activities.

ON3 Carry out independent scientific research in the field of educational psychology, methods of teaching physics

ON4 Demonstrate the developmental knowledge and understanding gained at the higher education level that is the basis of original development

#### **Prerequisites**

Bachelor

#### **Postrequisites**

Equilibrium properties of substances Heat engines and their applications Thermodynamic phenomena in animate and inanimate nature

## **Theory of electronic devices with curvilinear bunches**

Discipline cycle	Basic disciplines
Course	1
Credits count	5
Knowledge control form	Examination

#### **Short description of discipline**

In radio engineering and electronics of the school physics course, the movement of particles in various fields is considered. In microwave devices, the motion of particles with curvilinear trajectories is considered.

This problem is considered in electric and magnetic fields of various configurations. A uniform field is chosen as the magnetic field, and the electric fields of the quadrupole and parabolic capacitors are chosen as the electric field. The problem is considered in the relativistic approximation.

#### **Purpose of studying of the discipline**

the ability to use knowledge of modern natural science picture of the world in education and careers;

## Learning Outcomes

ON1 Apply fundamental scientific, pedagogical, managerial, communicative knowledge and skills in professional activities.

ON3 Carry out independent scientific research in the field of educational psychology, methods of teaching physics

ON4 Demonstrate the developmental knowledge and understanding gained at the higher education level that is the basis of original development

## Learning outcomes by discipline

As a result of studying the discipline, the undergraduate must:

know:

• fundamental laws of quantum theory;

be able to:

- explain the fundamental concepts of theoretical physics;

have skills:

- understanding of the limits of applicability of relativistic theories;

- Skills in working with scientific literature

- the general structure of theoretical physics;

be competent:

-correct use of modern ideas in solving physical problems

## Prerequisites

Bachelor

## Postrequisites

Equilibrium properties of substances Heat engines and their applications Thermodynamic phenomena in animate and inanimate nature

## Physics of semiconductors and their applications

Discipline cycle	Basic disciplines
Course	1
Credits count	5
Knowledge control form	Examination

## Short description of discipline

Semiconductors play a huge role in modern technology and science. They are an integral part in the manufacture of various semiconductor devices. In this course, the properties of semiconductors, their action, also band theory, various transitions in semiconductors, diodes, triodes, various rectifiers, amplifiers, and so on are considered. The Fermi theory are considered.

## Purpose of studying of the discipline

be professionally trained in matters of statistical thermodynamics of equilibrium processes.

## Learning Outcomes

ON1 Apply fundamental scientific, pedagogical, managerial, communicative knowledge and skills in professional activities.

ON3 Carry out independent scientific research in the field of educational psychology, methods of teaching physics

ON4 Demonstrate the developmental knowledge and understanding gained at the higher education level that is the basis of original development

## Learning outcomes by discipline

to be competent:

in basic physical phenomena, their manifestations in nature and their use in technology, their mathematical description; in basic measuring instruments, in solving specific problems of physics and their connection with the general laws of physics.

## Prerequisites

Bachelor

## Postrequisites

Equilibrium properties of substances Heat engines and their applications Thermodynamic phenomena in animate and inanimate nature

## Methods of teaching physics with elements of folk pedagogy

Discipline cycle	Basic disciplines
Course	1
Credits count	5
Knowledge control form	Examination

## Short description of discipline

The possibility of using folk pedagogy in teaching physics is high, since the samples selected from the materials of ethnopedagogy study the vivid manifestations of physical phenomena in the environment and nature, carry out an effective study of theoretical data in this discipline. Folk pedagogy provides for a system of character activity, its organization and implementation, an effective combination of practical models with modern education in the formation of students` cognitive skills.

## Purpose of studying of the discipline

Demonstrates basic knowledge of general physics course with elements of folk pedagogy.

## Learning Outcomes

ON3 Carry out independent scientific research in the field of educational psychology, methods of teaching physics

ON6 Compare traditional and innovative educational methods and technologies for teaching physics to organize an effective educational process.

ON7 Organize the cognitive activity of students, apply the basics of the methodology of the educational process in physics in their activities.

## Learning outcomes by discipline

As a result of studying the subject, the graduate should know: folk pedagogic tools - proverbs, riddles, fairy tales, poems, arguments, legends, heroes` songs, national games, sagas, etc. effectively using the main problems, examples, the features of their physical meaning, the main concepts, quantities, the basis of methods and processing of the true appearance of phenomena.

should be able to understand:

basic physical concepts using the elements of folk pedagogy, their observation in nature and their use in technology; must be able to:

realizing the goals of education, development, upbringing, working on the basis of being able to connect one's own attitude to life, various social opinions in one's environment, national values in one's mind, being able to improve the meaning of physics, solve problems using the elements of folk pedagogy and connect it with the laws of physics to know.

### Prerequisites

Bachelor

### Postrequisites

Actual problems of modern physics Modern methods of teaching general physics course

## Physical concept formation technique

Discipline cycle	Profiling discipline
Course	1
Credits count	5
Knowledge control form	Examination

### Short description of discipline

The ways and means of forming physical concepts in all important branches of physics in high school are considered. Masters the concepts of physical phenomena, processes, equipment, the essence of formulas, the formation of physical quantities. Masters the meaning and essence of physical concepts, and also studies ways of mastering them. Compares and defines physical concepts in the disclosure of the content of environmental problems. Distinguishes physical concepts in the chapter, draws conclusions.

### Purpose of studying of the discipline

Demonstrates basic knowledge of the analysis of issues of fundamental physical quantities.

### Learning Outcomes

ON3 Carry out independent scientific research in the field of educational psychology, methods of teaching physics

ON6 Compare traditional and innovative educational methods and technologies for teaching physics to organize an effective educational process.

ON7 Organize the cognitive activity of students, apply the basics of the methodology of the educational process in physics in their activities.

### Learning outcomes by discipline

At the end of the discipline, a student of the specialty "7M01502-Physics"

Expected learning outcomes:

Knowledge:

- the main types of educational technologies, their focus;

- Features of the organization of forms of educational work using learning technologies in accordance with the methodology for the formation of physical concepts.

Mastery:

- skills of formation of physical concepts, their implementation in practice;

- Knowledge of the principle of operation of fixed assets.

Mastery:

- be able to model the essence of physical phenomena, their mathematical expressions and physical processes.

Understanding:

- Basic physical processes, phenomena, their origin in nature, their application in technology

Mastery:

- skills of organization of educational, creative, constructive work of students.

Have:

- skills of organizing creative, project work;

- the ability to use computer programs in the process of teaching physics

Formed competencies:

- organization of student learning using various learning technologies;

- planning of educational work on the formation of physical concepts using different teaching technologies;

- be able to use scientific, educational and reference literature in work;

- apply the basic laws of physics in solving specific problems.

### Prerequisites

Methods of teaching physics with elements of folk pedagogy Methods of teaching physics with elements of folk pedagogy Using elements of folk pedagogy in physics at secondary school

### Postrequisites

The content of the renewed physics in the educational system of higher education New educational technologies in the process of teaching physics The problems of maintaining updated physics in the educational system of higher education Ways to use learning technologies in physics

## Credit technology in teaching physics

Discipline cycle	Profiling discipline
Course	1
Credits count	5
Knowledge control form	Examination

### Short description of discipline

Issues related to modern mastering are considered. Attention is paid to the main types of learning tasks, modern means of teaching physics. In the general course of physics, the features of the case method, design method, active teaching methods, modeling methods in teaching physics, group, pair teaching methods are used. The advantages of problem-based learning, the use of elements of research activity and skills in the educational process are considered.

## **Purpose of studying of the discipline**

*Demonstrates basic knowledge of physics teaching*

## **Learning Outcomes**

*ON3 Carry out independent scientific research in the field of educational psychology, methods of teaching physics*

*ON6 Compare traditional and innovative educational methods and technologies for teaching physics to organize an effective educational process.*

*ON7 Organize the cognitive activity of students, apply the basics of the methodology of the educational process in physics in their activities.*

## **Learning outcomes by discipline**

*At the end of the discipline, a student of the specialty "7M01502-Physics"*

*Expected learning outcomes:*

*Knowledge:*

*- the main types of educational technologies, their focus;*

*- Features of the organization of forms of educational work using learning technologies in accordance with the methodology for the formation of physical concepts.*

*Mastery:*

*- skills of formation of physical concepts, their implementation in practice;*

*- Knowledge of the principle of operation of fixed assets.*

*Mastery:*

*- be able to model the essence of physical phenomena, their mathematical expressions and physical processes.*

*Understanding:*

*- Basic physical processes, phenomena, their origin in nature, their application in technology*

*Mastery:*

*- skills of organization of educational, creative, constructive work of students.*

*Have:*

*- skills of organizing creative, project work;*

*- the ability to use computer programs in the process of teaching physics*

*Formed competencies:*

*- organization of student learning using various learning technologies;*

*- planning of educational work on the formation of physical concepts using different teaching technologies;*

*- be able to use scientific, educational and reference literature in work;*

*- apply the basic laws of physics in solving specific problems.*

## **Prerequisites**

*Methods of teaching physics with elements of folk pedagogy Methods of teaching physics with elements of folk pedagogy Using elements of folk pedagogy in physics at secondary school*

## **Postrequisites**

*Methods of teaching content of updated content in the secondary education system The content of the renewed physics in the educational system of higher education New educational technologies in the process of teaching physics The problems of maintaining updated physics in the educational system of higher education Ways to use learning technologies in physics Methods of teaching physics using new technologies*

## **Equilibrium properties of substances**

Discipline cycle	Profiling discipline
Course	1
Credits count	5
Knowledge control form	Examination

## **Short description of discipline**

*The course examines the basics of calculation and study of thermodynamic systems. The discipline is based on the properties of gases and liquids, the first and second laws of thermodynamics, the use of the concept of entropy and the direction of processes in living and inanimate nature, the processes of substance transfer: diffusion, thermal conductivity.*

## **Purpose of studying of the discipline**

*- training of specialists who can competently solve numerous practically and theoretically important problems, including those arising at the junction of various scientific areas;*

*- to form the basic concepts and ideas of non-relativistic quantum mechanics - a fundamental physical theory that studies the motion of microparticles in external fields at speeds far from the speed of light.*

*- to give students a deep understanding of the laws of the microworld. The student must get a clear idea of the physical nature of phenomena that obey quantum laws, learn how to interpret quantum processes. The main attention should be paid to fundamental general and approximate methods, so that the student knows the limits of their applicability and is able to use them effectively in practice.*

## **Learning Outcomes**

*ON1 Apply fundamental scientific, pedagogical, managerial, communicative knowledge and skills in professional activities.*

*ON3 Carry out independent scientific research in the field of educational psychology, methods of teaching physics*

*ON4 Demonstrate the developmental knowledge and understanding gained at the higher education level that is the basis of original development*

## **Learning outcomes by discipline**

*As a result of studying the discipline, the undergraduate must:*

*know:*

*- basic concepts and fundamental laws of quantum theory;*

*own:*

*- knowledge sufficient for the use of quantum concepts in the analysis of the microworld;*

*learn:*



- basic quantum concepts used in the study of the microworld;

be able to:

- explain the fundamental concepts of non-relativistic quantum mechanics, physically interpret quantum processes;

understand:

- general laws of quantum mechanics;

have:

- understanding of the limits of applicability of quantum theory;

purchase:

- skills of working with scientific, educational-methodical and reference literature,

- Skills for solving basic practical problems.

### **Prerequisites**

*Modification of crystals in solid state physics Physics of semiconductors and their applications Study of crystal modification issues*

### **Postrequisites**

*The mechanism of formation of radiating defects in firm bodies Interaction of neutrons with matter Sources of radiation*

## **Modern methods of teaching general physics course**

Discipline cycle	Profiling discipline
Course	1
Credits count	5
Knowledge control form	Examination

### **Short description of discipline**

*Can consider and apply modern methods of teaching general physics. The organization of educational activities is based on the knowledge of modern methods of mastering individual sections. Acquaintance with the methods of analysis of didactic materials, demonstration of the relevant methods of their application in the process of teaching physics; The special course draws the attention of undergraduates to the methods and principles of the formation of physical concepts, teaches them to reason and process physical processes and phenomena.*

### **Purpose of studying of the discipline**

- consider modern teaching methods, show ways of their application in the educational process;

- introduce the methods of selection of didactic materials, show the appropriate methods of their application in the process of teaching physics;

- in a special course draws the attention of undergraduates to the methods and principles of the formation of physical concepts, allows them to discuss and implement physical processes and phenomena;

### **Learning Outcomes**

*ON3 Carry out independent scientific research in the field of educational psychology, methods of teaching physics*

*ON6 Compare traditional and innovative educational methods and technologies for teaching physics to organize an effective educational process.*

*ON7 Organize the cognitive activity of students, apply the basics of the methodology of the educational process in physics in their activities.*

### **Learning outcomes by discipline**

*At the end of the discipline, a student of the specialty "7M01502-Physics"*

*Expected learning outcomes:*

*Knowledge:*

- the main types of educational technologies, their focus;

- Features of the organization of forms of educational work using learning technologies in accordance with the methodology for the formation of physical concepts.

*Mastery:*

- skills of formation of physical concepts, their implementation in practice;

- Knowledge of the principle of operation of fixed assets.

*Mastery:*

- be able to model the essence of physical phenomena, their mathematical expressions and physical processes.

*Understanding:*

- Basic physical processes, phenomena, their origin in nature, their application in technology

*Mastery:*

- skills of organization of educational, creative, constructive work of students.

*Have:*

- skills of organizing creative, project work;

- the ability to use computer programs in the process of teaching physics

*Formed competencies:*

- organization of student learning using various learning technologies;

- planning of educational work on the formation of physical concepts using different teaching technologies;

- be able to use scientific, educational and reference literature in work;

- apply the basic laws of physics in solving specific problems.

### **Prerequisites**

*Methods of teaching physics with elements of folk pedagogy Methods of teaching physics with elements of folk pedagogy Using elements of folk pedagogy in physics at secondary school*

### **Postrequisites**

*Methods of teaching content of updated content in the secondary education system The content of the renewed physics in the educational system of higher education Credit technology in teaching physics New educational technologies in the process of teaching physics Ways to use learning technologies in physics Methods of teaching physics using new technologies*

## **Heat engines and their applications**

Discipline cycle	Profiling discipline
Course	1
Credits count	5
Knowledge control form	Examination

### Short description of discipline

*Thermal machines are devices in which thermal energy is obtained from various sources. Here, various sources of thermal energy are considered and how they can be used in mechanical devices. In this course, the work of nuclear power plants, galvanic cells, solar panels and their use in industry will also be considered.*

### Purpose of studying of the discipline

- training of specialists who can competently solve numerous practically and theoretically important problems, including those arising at the junction of various scientific areas;
- to form the basic concepts and ideas of non-relativistic quantum mechanics - a fundamental physical theory that studies the motion of microparticles in external fields at speeds far from the speed of light.
- to give students a deep understanding of the laws of the microworld. The student must get a clear idea of the physical nature of phenomena that obey quantum laws, learn how to interpret quantum processes. The main attention should be paid to fundamental general and approximate methods, so that the student knows the limits of their applicability and is able to use them effectively in practice.

### Learning Outcomes

ON1 Apply fundamental scientific, pedagogical, managerial, communicative knowledge and skills in professional activities.

ON3 Carry out independent scientific research in the field of educational psychology, methods of teaching physics

ON4 Demonstrate the developmental knowledge and understanding gained at the higher education level that is the basis of original development

### Learning outcomes by discipline

As a result of studying the discipline, the undergraduate must:

know:

- basic concepts and fundamental laws of quantum theory;

own:

- knowledge sufficient for the use of quantum concepts in the analysis of the microworld;

learn:

- basic quantum concepts used in the study of the microworld;

be able to:

- explain the fundamental concepts of non-relativistic quantum mechanics, physically interpret quantum processes;

understand:

- general laws of quantum mechanics;

have:

- understanding of the limits of applicability of quantum theory;

purchase:

- skills of working with scientific, educational-methodical and reference literature,

- Skills for solving basic practical problems.

ON 1 Apply fundamental scientific, pedagogical, managerial, communicative knowledge and skills in professional activities.

ON3 Carry out independent scientific research in the field of educational psychology, methods of teaching physics

ON4 Demonstrate the developmental knowledge and understanding gained at the higher education level that is the basis of original development

### Prerequisites

*Modification of crystals in solid state physics Physics of semiconductors and their applications Study of crystal modification issues*

### Postrequisites

*The mechanism of formation of radiating defects in firm bodies Interaction of neutrons with matter Sources of radiation*

## Thermodynamic phenomena in animate and inanimate nature

Discipline cycle	Profiling discipline
Course	1
Credits count	5
Knowledge control form	Examination

### Short description of discipline

*The laws of thermodynamics are the same in living and inanimate nature. This course examines the accumulation of the use of thermal energy by living organisms, considers the laws of thermodynamics, the concept of entropy as applied to living systems, as well as the flow of processes in inanimate and living nature.*

### Purpose of studying of the discipline

- training of specialists who can competently solve numerous practically and theoretically important problems, including those arising at the junction of various scientific areas;
- to form the basic concepts and ideas of non-relativistic quantum mechanics - a fundamental physical theory that studies the motion of microparticles in external fields at speeds far from the speed of light.
- to give students a deep understanding of the laws of the microworld. The student must get a clear idea of the physical nature of phenomena that obey quantum laws, learn how to interpret quantum processes. The main attention should be paid to fundamental general and approximate methods, so that the student knows the limits of their applicability and is able to use them effectively in practice.

### Learning Outcomes

ON1 Apply fundamental scientific, pedagogical, managerial, communicative knowledge and skills in professional activities.

ON3 Carry out independent scientific research in the field of educational psychology, methods of teaching physics

ON4 Demonstrate the developmental knowledge and understanding gained at the higher education level that is the basis of original development

## Learning outcomes by discipline

As a result of studying the discipline, the undergraduate must:

know:

- basic concepts and fundamental laws of quantum theory;

own:

- knowledge sufficient for the use of quantum concepts in the analysis of the microworld;

learn:

- basic quantum concepts used in the study of the microworld;

be able to:

- explain the fundamental concepts of non-relativistic quantum mechanics, physically interpret quantum processes;

understand:

- general laws of quantum mechanics;

have:

- understanding of the limits of applicability of quantum theory;

purchase:

- skills of working with scientific, educational-methodical and reference literature,

- Skills for solving basic practical problems.

## Prerequisites

Modification of crystals in solid state physics Physics of semiconductors and their applications Study of crystal modification issues

## Postrequisites

The mechanism of formation of radiating defects in firm bodies Interaction of neutrons with matter Sources of radiation

## Methods of teaching physics using new technologies

Discipline cycle	Profiling discipline
Course	2
Credits count	5
Knowledge control form	Examination

## Short description of discipline

Considering the issues of personal development in additional innovations, a number of methodological issues that contribute to the effective use of the school (modern approaches to teaching and learning, education of simple logical thinking, ability to use data and communication information in teaching, skilled and talented, business-minded students, age characteristics of gifted students, favorable education and training, learning management and leadership).

## Purpose of studying of the discipline

Complex use of elements of pedagogical technologies in different variations in physics classes contributes to the effective organization of the educational process, activation of cognitive activity, implementation of competent teacher's activities.

## Learning Outcomes

ON2 Practice various forms and methods of active teaching of physics to integrate the most effective modern educational technologies into the methods of teaching physics in universities.

ON7 Organize the cognitive activity of students, apply the basics of the methodology of the educational process in physics in their activities.

ON8 Prepare undergraduates for conducting classes with in-depth theoretical and practical study of modern physics in general education schools and other educational institutions necessary for daily professional activities and continuing education in doctoral studies.

ON9 Conduct information-analytical and information-bibliographic work with the involvement of modern information technologies.

## Learning outcomes by discipline

It would be more correct to speak about new information technologies in the context of the concepts of new "pedagogical technologies". The concept of "pedagogical technology" has recently become more and more widespread in the theory of learning. The adaptation of new technologies in the educational sphere is especially well traced by such an indicator as the introduction of new information technologies into education.

ON2 Practice various forms and methods of active teaching of physics to integrate the most effective modern educational technologies into the methods of teaching physics in universities

ON7 Organize the cognitive activity of students, apply the basics of the methodology of the educational process in physics in their activities

ON8 Prepare undergraduates for conducting classes with in-depth theoretical and practical study of modern physics in general education schools and other educational institutions necessary for daily professional activities and continuing education in doctoral studies

ON9 Conduct information-analytical and information-bibliographic work with the involvement of modern information technologies

## Prerequisites

Modern methods of teaching general physics course Physical concept formation technique Credit technology in teaching physics

## Postrequisites

Practice research

## The method of forming fundamental concepts in solving physics problems

Discipline cycle	Profiling discipline
Course	2
Credits count	5
Knowledge control form	Examination

## Short description of discipline

Training will be provided for specialists who are able to improve experimentation in secondary and higher schools and who are capable of solving many-sided practical problems. The methodological basis for solving physical problems is the highest level of a unified system of physical education in the specialty "physics". He studies the basic physical experiments, the features of their formulation, the basic concepts, quantities, the basics of experimental methods and the processing of measurement results.

## Purpose of studying of the discipline

*Demonstrates basic knowledge of the analysis of issues of fundamental physical quantities.*

### **Learning Outcomes**

*ON2 Practice various forms and methods of active teaching of physics to integrate the most effective modern educational technologies into the methods of teaching physics in universities.*

*ON7 Organize the cognitive activity of students, apply the basics of the methodology of the educational process in physics in their activities.*

*ON8 Prepare undergraduates for conducting classes with in-depth theoretical and practical study of modern physics in general education schools and other educational institutions necessary for daily professional activities and continuing education in doctoral studies.*

### **Learning outcomes by discipline**

*As a result of studying the subject, the master's student should know:*

*- processing of basic physical experiments, features of their creation, basic concepts, values, basics of experimental methods and measurement results;*

*Know:*

*- tools and methods of measuring the main parameters of systems*

*ability to work;*

*- physical experiments on natural objects*

*mastering the technique, thermodynamic parameters, constants.*

*To do:*

*- to be able to explain the basic concepts of physics in making physical problems*

*- learns the skills and qualifications of using various equipment in making physical experimental reports.*

*- it is necessary to learn ways to improve experimenting in middle and high school;*

*Having the skills:*

*- formation of physics teaching, professional-practical qualifications and skills in secondary and special secondary educational institutions using modern methods;*

*- ability to work with scientific literature*

*- to be able to work with physical devices, to improve these devices, to make experimental calculations and connect them with the laws of physics, to be able to conduct scientific research work;*

### **Prerequisites**

*Modern methods of teaching general physics course Physical concept formation technique Credit technology in teaching physics*

### **Postrequisites**

*Practice research*

## **The problems of maintaining updated physics in the educational system of higher education**

Discipline cycle Profiling discipline

Course 2

Credits count 5

Knowledge control form Examination

### **Short description of discipline**

*Development of students' skills of self-education, self-regulation of future physics teachers; formation of an active citizen who is competent in digital technologies, ready to live successfully in the modern world, able to have an effective dialogue with different people.*

*The organization of the educational process, which contributes to the professional development of teachers and the reform of education to form a future specialist, provides the necessary knowledge and practical training.*

### **Purpose of studying of the discipline**

*teamwork; cognitive, communicative, socially active.*

*formation of an individual who has mastered the subject, methodological, qualification and qualification systems, further self-realization of professional development.*

### **Learning Outcomes**

*ON2 Practice various forms and methods of active teaching of physics to integrate the most effective modern educational technologies into the methods of teaching physics in universities.*

*ON7 Organize the cognitive activity of students, apply the basics of the methodology of the educational process in physics in their activities.*

*ON8 Prepare undergraduates for conducting classes with in-depth theoretical and practical study of modern physics in general education schools and other educational institutions necessary for daily professional activities and continuing education in doctoral studies.*

### **Learning outcomes by discipline**

*As a result of studying the subject, the master's student should know:*

*Know:*

*• In the educational system of higher educational institutions, the future teacher should master the methodology of revitalizing the process of attracting students to education by methods of teaching the updated content of knowledge in the subject of physics;*

*To do:*

*• Having the ability to critically think (reflection) about one's own experience, self-improvement in the future teacher according to the updated methods of teaching the content of physics in the educational system of higher education institutions;*

*• Willingness to actively work within the professional association of future school teachers on methods of teaching the updated content of physics in the educational system of higher education institutions;*

*Having the skills:*

*• formation of conceptual understanding bases and practical skills in students in the context of seven modules that form the basis of the program;*

*• Must acquire the ability to use different teaching methods in the teaching process*

### **Prerequisites**

*Modern methods of teaching general physics course Physical concept formation technique Credit technology in teaching physics*

### **Postrequisites**

*Practice research*

## Ways to use learning technologies in physics

Discipline cycle	Profiling discipline
Course	2
Credits count	5
Knowledge control form	Examination

### Short description of discipline

*The problem of introducing innovative, information technologies in the teaching of physics in modern schools is analyzed. It is characterized by a high level of motivation, a conscious need to acquire knowledge and skills, and working capacity. The use of computers contributes to the introduction of new modern pedagogical technologies into the educational process. Help in feeling the importance of laws, creating conditions for the self-realization of each student in the learning process, developing the need for independent work.*

### Purpose of studying of the discipline

*Complex use of elements of pedagogical technologies in different variations in physics classes contributes to the effective organization of the educational process, activation of cognitive activity, implementation of competent teacher's activities.*

### Learning Outcomes

*ON2 Practice various forms and methods of active teaching of physics to integrate the most effective modern educational technologies into the methods of teaching physics in universities.*

*ON7 Organize the cognitive activity of students, apply the basics of the methodology of the educational process in physics in their activities.*

*ON8 Prepare undergraduates for conducting classes with in-depth theoretical and practical study of modern physics in general education schools and other educational institutions necessary for daily professional activities and continuing education in doctoral studies.*

*ON9 Conduct information-analytical and information-bibliographic work with the involvement of modern information technologies.*

### Learning outcomes by discipline

*-She studies the problem of introducing innovative information technologies into modern school education in physics.*

*-It can be characterized by a high level of motivation, a conscious need to acquire knowledge and skills, and efficiency.*

*-The use of computers contributes to the introduction of new modern pedagogical technologies into the educational process.*

*-Helps to feel the importance of the rules, helps to realize the individuality of each student in the learning process, can develop the need for independent work.*

### Prerequisites

*Modern methods of teaching general physics course Physical concept formation technique Credit technology in teaching physics*

### Postrequisites

*Practice research*

## The content of the renewed physics in the educational system of higher education

Discipline cycle	Profiling discipline
Course	2
Credits count	5
Knowledge control form	Examination

### Short description of discipline

*To meet the business needs of future physics teachers in mastering a set of knowledge and skills, to help teachers prepare for systematic professional development in an ever-changing environment. To support innovative processes in education, mastering the necessary strategies for solving problems and ensuring the optimality of methodological work. Perform tasks that determine the basis for the formation of pedagogical methods and approaches (what, why and how).*

### Purpose of studying of the discipline

*teamwork; cognitive, communicative, socially active.*

*formation of an individual who has mastered the subject, methodological, qualification and qualification systems, further self-realization of professional development.*

### Learning Outcomes

*ON2 Practice various forms and methods of active teaching of physics to integrate the most effective modern educational technologies into the methods of teaching physics in universities.*

*ON7 Organize the cognitive activity of students, apply the basics of the methodology of the educational process in physics in their activities.*

*ON8 Prepare undergraduates for conducting classes with in-depth theoretical and practical study of modern physics in general education schools and other educational institutions necessary for daily professional activities and continuing education in doctoral studies.*

### Learning outcomes by discipline

*As a result of studying the subject, the master's student should know:*

*Know:*

*• In the educational system of higher educational institutions, the future teacher should master the methodology of revitalizing the process of attracting students to education by methods of teaching the updated content of knowledge in the subject of physics;*

*To do:*

*• Having the ability to critically think (reflection) about one's own experience, self-improvement in the future teacher according to the updated methods of teaching the content of physics in the educational system of higher education institutions;*

*• Willingness to actively work within the professional association of future school teachers on methods of teaching the updated content of physics in the educational system of higher education institutions;*

*Having the skills:*

*• formation of conceptual understanding bases and practical skills in students in the context of seven modules that form the basis of the program;*

*• Must acquire the ability to use different teaching methods in the teaching process*

### Prerequisites

*Modern methods of teaching general physics course Physical concept formation technique Credit technology in teaching physics*

## Postrequisites

Practice research

## Interaction of neutrons with matter

Discipline cycle	Profiling discipline
Course	2
Credits count	5
Knowledge control form	Examination

### Short description of discipline

*When neutrons of different energies enter a substance, they cause nuclear reactions. Depending on the energy, they are subdivided into elastic, inelastic, and proper nuclear reactions. Neutrons passing through matter can cause various damage. These damages must be studied, since the choice of protection material necessary for the construction of nuclear power plants and their further operation depends on this.*

### Purpose of studying of the discipline

*The purpose of the course is to generalize observations, practical experience and experiments presented at the appropriate mathematical level of physical theory, and to present the description of electromagnetic waves within the framework of Maxwell's theory using the appropriate quantum concepts. To show that, unlike other branches of physics dealing with atomic physics and electromagnetic radiation, not in the studied wavelength range, but in a set of specific research methods historically developed only mainly in the study of light.*

### Learning Outcomes

*ON5 Classify physical phenomena and their corresponding theoretical models, evaluate the effectiveness of their application; describe the physical processes of the general physics course, draw up algorithms for solving problems in the field of physics and pedagogy.*

*ON8 Prepare undergraduates for conducting classes with in-depth theoretical and practical study of modern physics in general education schools and other educational institutions necessary for daily professional activities and continuing education in doctoral studies.*

*ON9 Conduct information-analytical and information-bibliographic work with the involvement of modern information technologies.*

### Learning outcomes by discipline

*\* Formation of an idea of the modern scientific picture of the world.*

*\* Formation of knowledge about modern methods and instruments for the study of space objects.*

*\* Ability to work with large spatial and temporal scales, analyze data from numerous and various observations, understand the complex nature of phenomena.*

*The history of astronomy gives many examples of scientific feats of scientists, their diligence, dedication.*

*\* Suitable for promoting moral and aesthetic education, especially for observing the starry sky.*

*\* The study of the course should help to familiarize students with the main problems of modern physics .*

### Prerequisites

*Equilibrium properties of substances Heat engines and their applications Thermodynamic phenomena in animate and inanimate nature*

### Postrequisites

Final examination

## Sources of radiation

Discipline cycle	Profiling discipline
Course	2
Credits count	5
Knowledge control form	Examination

### Short description of discipline

*The laws of thermodynamics are the same in living and inanimate nature. This course examines the accumulation of the use of thermal energy by living organisms, considers the laws of thermodynamics, the concept of entropy as applied to living systems, as well as the flow of processes in inanimate and living nature.*

### Purpose of studying of the discipline

*The purpose of the course is to generalize observations, practical experience and experiments presented at the appropriate mathematical level of physical theory, and to present the description of electromagnetic waves within the framework of Maxwell's theory using the appropriate quantum concepts. To show that, unlike other branches of physics dealing with atomic physics and electromagnetic radiation, not in the studied wavelength range, but in a set of specific research methods historically developed only mainly in the study of light.*

### Learning Outcomes

*ON5 Classify physical phenomena and their corresponding theoretical models, evaluate the effectiveness of their application; describe the physical processes of the general physics course, draw up algorithms for solving problems in the field of physics and pedagogy.*

*ON8 Prepare undergraduates for conducting classes with in-depth theoretical and practical study of modern physics in general education schools and other educational institutions necessary for daily professional activities and continuing education in doctoral studies.*

*ON9 Conduct information-analytical and information-bibliographic work with the involvement of modern information technologies.*

### Learning outcomes by discipline

*\* Formation of an idea of the modern scientific picture of the world.*

*\* Formation of knowledge about modern methods and instruments for the study of space objects.*

*\* Ability to work with large spatial and temporal scales, analyze data from numerous and various observations, understand the complex nature of phenomena.*

*The history of astronomy gives many examples of scientific feats of scientists, their diligence, dedication.*

*\* Suitable for promoting moral and aesthetic education, especially for observing the starry sky.*

*\* The study of the course should help to familiarize students with the main problems of modern physics .*

### Prerequisites

*Equilibrium properties of substances Heat engines and their applications Thermodynamic phenomena in animate and inanimate nature*

### Postrequisites

## Methodology of decision of olimpiad tasks on physics

Discipline cycle	Profiling discipline
Course	2
Credits count	5
Knowledge control form	Examination

### Short description of discipline

*Studies the concepts, phenomena, laws and principles of physics in the solution of Olympic problems, teaches to discuss and analyze and process physical processes; determines physical experiments in all sections, features of their performance, quantities, basics of experimental methods and measurement results in solving problems; It is the highest stage of a unified system of special Olympic ways of solving physical problems through the methodological basis, so the logical abilities increase.*

### Purpose of studying of the discipline

*Demonstrates basic knowledge of the analysis of issues of fundamental physical quantities.*

### Learning Outcomes

*ON2 Practice various forms and methods of active teaching of physics to integrate the most effective modern educational technologies into the methods of teaching physics in universities.*

*ON7 Organize the cognitive activity of students, apply the basics of the methodology of the educational process in physics in their activities.*

*ON8 Prepare undergraduates for conducting classes with in-depth theoretical and practical study of modern physics in general education schools and other educational institutions necessary for daily professional activities and continuing education in doctoral studies.*

### Learning outcomes by discipline

*As a result of studying the subject, the master's student should know:*

*- processing of basic physical experiments, features of their creation, basic concepts, values, basics of experimental methods and measurement results;*

*Know:*

*- tools and methods of measuring the main parameters of systems*

*ability to work;*

*- physical experiments on natural objects*

*mastering the technique, thermodynamic parameters, constants.*

*To do:*

*- to be able to explain the basic concepts of physics in making physical problems*

*- learns the skills and qualifications of using various equipment in making physical experimental reports.*

*- it is necessary to learn ways to improve experimenting in middle and high school;*

*Having the skills:*

*- formation of physics teaching, professional-practical qualifications and skills in secondary and special secondary educational institutions using modern methods;*

*- ability to work with scientific literature*

*- to be able to work with physical devices, to improve these devices, to make experimental calculations and connect them with the laws of physics, to be able to conduct scientific research work;*

### Prerequisites

*Modern methods of teaching general physics course Physical concept formation technique Credit technology in teaching physics*

### Postrequisites

*Practice research*

## Methodology of decision of experimental tasks on physics

Discipline cycle	Profiling discipline
Course	2
Credits count	5
Knowledge control form	Examination

### Short description of discipline

*To observe the ability to work with physical devices, to improve these devices, to solve practical problems and to connect it with the laws of physics.*

*Must know the basic concepts and basic laws of physics, master the methods of solving problems in physics through the methodological basis of solving physical problems. Ability to obtain the results of statistical processing of computer operation and measurement results; be able to solve experimental problems.*

### Purpose of studying of the discipline

*Demonstrates basic knowledge of the analysis of issues of fundamental physical quantities.*

### Learning Outcomes

*ON2 Practice various forms and methods of active teaching of physics to integrate the most effective modern educational technologies into the methods of teaching physics in universities.*

*ON7 Organize the cognitive activity of students, apply the basics of the methodology of the educational process in physics in their activities.*

*ON8 Prepare undergraduates for conducting classes with in-depth theoretical and practical study of modern physics in general education schools and other educational institutions necessary for daily professional activities and continuing education in doctoral studies.*

### Learning outcomes by discipline

*As a result of studying the subject, the master's student should know:*

*- processing of basic physical experiments, features of their creation, basic concepts, values, basics of experimental methods and measurement results;*

*Know:*

*- tools and methods of measuring the main parameters of systems*

ability to work;

- physical experiments on natural objects

mastering the technique, thermodynamic parameters, constants.

To do:

- to be able to explain the basic concepts of physics in making physical problems

- learns the skills and qualifications of using various equipment in making physical experimental reports.

- it is necessary to learn ways to improve experimenting in middle and high school;

Having the skills:

- formation of physics teaching, professional-practical qualifications and skills in secondary and special secondary educational institutions using modern methods;

- ability to work with scientific literature

- to be able to work with physical devices, to improve these devices, to make experimental calculations and connect them with the laws of physics, to be able to conduct scientific research work;

### Prerequisites

Modern methods of teaching general physics course Physical concept formation technique Credit technology in teaching physics

### Postrequisites

Practice research

## Methods of teaching content of updated content in the secondary education system

Discipline cycle Profiling discipline

Course 2

Credits count 5

Knowledge control form Examination

### Short description of discipline

value-oriented; action; personality-oriented; built-in; Communicative methods are the main guidelines for creating the structure and content of the curriculum in the subject. Students develop the skills to use ICT in teaching updated methods of teaching the content of knowledge in physics in the education system. In the process of searching and processing information, the team exchanges ideas, evaluates and improves their work, considers a wide range of different equipment and applications.

### Purpose of studying of the discipline

teamwork; cognitive, communicative, socially active.

formation of an individual who has mastered the subject, methodological, qualification and qualification systems, further self-realization of professional development.

### Learning Outcomes

ON2 Practice various forms and methods of active teaching of physics to integrate the most effective modern educational technologies into the methods of teaching physics in universities.

ON7 Organize the cognitive activity of students, apply the basics of the methodology of the educational process in physics in their activities.

ON8 Prepare undergraduates for conducting classes with in-depth theoretical and practical study of modern physics in general education schools and other educational institutions necessary for daily professional activities and continuing education in doctoral studies.

### Learning outcomes by discipline

As a result of studying the subject, the master's student should know:

Know:

• In the educational system of higher educational institutions, the future teacher should master the methodology of revitalizing the process of attracting students to education by methods of teaching the updated content of knowledge in the subject of physics;

To do:

• Having the ability to critically think (reflection) about one's own experience, self-improvement in the future teacher according to the updated methods of teaching the content of physics in the educational system of higher education institutions;

• Willingness to actively work within the professional association of future school teachers on methods of teaching the updated content of physics in the educational system of higher education institutions;

Having the skills:

• formation of conceptual understanding bases and practical skills in students in the context of seven modules that form the basis of the program;

• Must acquire the ability to use different teaching methods in the teaching process

ON2 Practice various forms and methods of active teaching of physics to integrate the most effective modern educational technologies into the methods of teaching physics in universities

ON7 Organize the cognitive activity of students, apply the basics of the methodology of the educational process in physics in their activities

ON8 Prepare undergraduates for conducting classes with in-depth theoretical and practical study of modern physics in general education schools and other educational institutions necessary for daily professional activities and continuing education in doctoral studies

### Prerequisites

Modern methods of teaching general physics course Physical concept formation technique Credit technology in teaching physics

### Postrequisites

Practice research

## The mechanism of formation of radiating defects in firm bodies

Discipline cycle Profiling discipline

Course 2

Credits count 5

Knowledge control form Examination

### Short description of discipline

The course examines the effect of radiation on the properties of crystalline solids. Sources of radiation and their properties. Types of



defects in solids, methods for obtaining defects in solids. X-ray sources. X-ray diffraction analysis. Radiation exposure of solids, influence on the thermal properties of solids. on the electrical properties of solids. Influence on the mechanical properties of solids.

### **Purpose of studying of the discipline**

The purpose of the course is to generalize observations, practical experience and experiments presented at the appropriate mathematical level of physical theory, and to present the description of electromagnetic waves within the framework of Maxwell's theory using the appropriate quantum concepts. To show that, unlike other branches of physics dealing with atomic physics and electromagnetic radiation, not in the studied wavelength range, but in a set of specific research methods historically developed only mainly in the study of light.

### **Learning Outcomes**

ON5 Classify physical phenomena and their corresponding theoretical models, evaluate the effectiveness of their application; describe the physical processes of the general physics course, draw up algorithms for solving problems in the field of physics and pedagogy.

ON8 Prepare undergraduates for conducting classes with in-depth theoretical and practical study of modern physics in general education schools and other educational institutions necessary for daily professional activities and continuing education in doctoral studies.

ON9 Conduct information-analytical and information-bibliographic work with the involvement of modern information technologies.

### **Learning outcomes by discipline**

\* Formation of an idea of the modern scientific picture of the world.

\* Formation of knowledge about modern methods and instruments for the study of space objects.

\* Ability to work with large spatial and temporal scales, analyze data from numerous and various observations, understand the complex nature of phenomena.

The history of astronomy gives many examples of scientific feats of scientists, their diligence, dedication.

\* Suitable for promoting moral and aesthetic education, especially for observing the starry sky.

\* The study of the course should help to familiarize students with the main problems of modern physics .

### **Prerequisites**

Equilibrium properties of substances Heat engines and their applications Thermodynamic phenomena in animate and inanimate nature

### **Postrequisites**

Basic and profile disciplines of the EP Final examination

## **New educational technologies in the process of teaching physics**

Discipline cycle	Profiling discipline
Course	2
Credits count	5
Knowledge control form	Examination

### **Short description of discipline**

Meeting educational needs by helping today's teachers be prepared for continuous professional development in a rapidly changing world. Support for innovative processes in education, ensuring the effectiveness of methodological work. Creation of conditions for providing the necessary practical training in digital educational technologies. Translates the most general concepts, laws and principles of physics, teaches them to discuss and process physical processes and phenomena

### **Purpose of studying of the discipline**

Complex use of elements of pedagogical technologies in different variations in physics classes contributes to the effective organization of the educational process, activation of cognitive activity, implementation of competent teacher's activities.

### **Learning Outcomes**

ON2 Practice various forms and methods of active teaching of physics to integrate the most effective modern educational technologies into the methods of teaching physics in universities.

ON7 Organize the cognitive activity of students, apply the basics of the methodology of the educational process in physics in their activities.

ON8 Prepare undergraduates for conducting classes with in-depth theoretical and practical study of modern physics in general education schools and other educational institutions necessary for daily professional activities and continuing education in doctoral studies.

ON9 Conduct information-analytical and information-bibliographic work with the involvement of modern information technologies.

### **Learning outcomes by discipline**

Can use interactive processes in the learning system, which includes the maximum effectiveness of the methodology. Digital educational technologies are mastered by implementing the necessary practical exercises. Paying attention to general concepts, definitions and laws of physics, they learn to analyze physical and phenomena, develop business skills for use in practice.

### **Prerequisites**

Modern methods of teaching general physics course Physical concept formation technique Credit technology in teaching physics

### **Postrequisites**

Practice research