Ministry of Education and Science of Ukraine
National Technical University
«Dnipro Polytechnic»

Department of Physics

**«APPROVED»**
Head of Department

Garkusha I. P. _____
«____»_____20_____ year

# WORK PROGRAM OF THE ACADEMIC DISCIPLINE
# "Physics 1"

| | |
|---|---|
| Field of study……..……/ | 18 Production and Technology |
| Speciality ……. | 185 Oil and Gas Engineering and Technology |
| Academic degree ……. | Bachelor |
| Academic program ……..... | «Oil and Gas Engineering and Technology» |
| Type of discipline ……..…….. | regulatory |
| Total workload …… | 5 ECTS credits (150 hours) |
| Type of final assessment ……..……... | exam |
| Period of study ……. | 2nd semester |
| Language of study ……... | English |

Lecturer: professor Pevzner M. Sh.

Prolonged: for 20 __ / 20___ academic year _____ ( _____ ) «__» ___ 20__y.
(signature, name, date)

for 20 __ / 20___ academic year _____ ( _____ ) «__» ___ 20__y.
(signature, name, date)

The Dnipro
NTU "DP"
2019

Work program of the academic discipline **«Physics 1»** for bachelor' specialty 185 «Oil and Gas Engineering and Technology» / I.P.Garkusha, M.Sh.Pevzner / NTU "Dnipro Polytechnic", Physics Department. – DA: NTU «DP», 2019. - 14 p.

Authors:
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The work program regulates:

- the purpose of the discipline;
- disciplinary learning outcomes formed on the basis of the transformation of the expected learning outcomes of the educational program;
- basic disciplines;
- the workload and distribution of educational process forms and types of classes;
- discipline program (thematic plan by type of training);
- algorithm for assessing the level of achievement of disciplinary learning outcomes (scales, tools, procedures and evaluation criteria);
- tools, equipment and software;
- recommended bibliography.

The work program is designed to implement a competency approach in planning the educational process, teaching discipline, preparing students for control activities, controlling the conduct of educational activities, internal and external quality assurance of higher education, accreditation of educational programs within the specialty.

The work program will be useful for forming the content of advanced training of scientific and pedagogical staff of the departments of the University.

Agreed to by the decision of the Methodical Commission of the specialty 185 "Oil and Gas Engineering and Technology" (protocol № ___ of ___.___._____).

Recommended for publication by the editorial board of NTU "DP" (protocol №___ of ___.___._____).

**CONTENT**

## 1. DISCIPLINE OBJECTIVES

In the educational and professional program of the Dnipro University of Technology specialty 185 "Oil and Gas Engineering and Technology" the distribution of program learning outcomes for the organizational forms of the educational process is done. In particular, the following learning outcomes are attributed to the disci[line B3 "Physics 1".

| | |
|---|---|
| | Know the modern physical theories, approaches, and fundamental principles of modern physics for using them when other technical and special disciplines are learn and be able to apply the physical laws when the concrete practical problems of the oil and gas engineering are considered, |

The discipline objectives:

- the formation of the natural scientific thinking skills in the methods of solving various scientific and technical problems;
- getting the skills of the scientific and technical measurement and estimate the errors of this procedure;
- the formation of competencies for the applications of the laws of classical and modern physics in the practical activity of the future specialist and in the study of other special disciplines provided by the educational and professional program for given area.

The realization of the goal requires transformation of program outcomes of training into disciplinary and adequate selection of the discipline content according to this criterion.

## 2. INTENDED DISCIPLINARY LEARNING OUTCOMES

| **Cipher PRN** | **Disciplinary learning outcomes (DRN)** | |
|---|---|---|
| | **cipher DRN** | **content** |
| | | Know the basic laws and concepts of classical (including relativistic) quantum mechanics, thermodynamics and statistical physics, electrodynamics, theory of oscillations and waves, physics of atoms, molecules, atomic nuclei and condensed matter |
| | | the Formation of abilities to generalize, analysis, information perception, setting scientific problem and choice of the method of its solution |

## 3. BASIC DISCIPLINES

The interdisciplinary connections: the study of «Physics 1» is provided by the study of subjects:

– higher mathematics;. differential equations; discrete mathematics; numerical methods.

The study of «Physics 1» provides studying of disciplines:

1) chemistry;
2) geology;
3) geodesy;
4) hydraulics;
5) thermodynamics and heat transfer;
6) material science;
7).electrical engineering and power supply;
8).technical mechanics and material resistance.
9) metrology standardization and certification;
10) hydroaerodynamics in drilllng.

## 4. WORKLOAD DISTRIBUTION BY THE FORM OF EDUCATIONAL PROCESS ORGANIZATION AND TYPES OF CLASSES

| **Type of training** | **Volume,** *hours* | **Distribution by form of study, hours** | | | | | |
|---|---|---|---|---|---|---|---|
| | | **day** | | **evening** | | **correspondence** | |
| | | class work | self-study | class work | self-study | class work | self-study |
| Lectures | 75 | 34 | 41 | – | – | 8 | 67 |
| Practical | – | – | – | – | – | – | – |
| Laboratory | 75 | 34 | 41 | – | – | 8 | 67 |
| Seminars | – | – | – | – | – | – | – |
| TOTAL | 150 | 68 | 82 | – | – | 16 | 134 |

## 5. DISCIPLINE PROGRAM BY TYPES OF CLASSES

| **Ciphers DRN** | **Types and topics of training** | **The volume of components, hours** |
|---|---|---|
| | **LECTURES** | **75** |
| | **1 Physical Foundations of Mechanics** | 16 |
| | Topic 1. Introduction to Mechanics | |
| | Theme 2. Elements of kinematics | |
| | Theme 3. Dynamics of material point and translational motion of a rigid body. Forces in mechanics | |
| | Topic 4. Dynamics of a rigid body which has a fixed axis of rotation | |
| | Topic 5. Conservation laws | |
| | Topic 6. Elements of the special theory of relativity | |
| | **2 Electrodynamics** | 22 |
| | Topic 1. General information about the electrostatic field; electrostatic field in vacuum | |
| | Topic 2. Electrostatic field in matter | |

| Ciphers DRN | Types and topics of training | The volume of components, hours |
|---|---|---|
| | Topic 3. DC electric current | |
| | Topic 4. A permanent magnetic field in a vacuum | |
| | Theme 5. The action of a magnetic field on moving charges and a conductor with a current | |
| | Topic 6. Magnetic field in matter | |
| | Topic 7. The phenomenon of electromagnetic induction | |
| | Topic 8. Maxwell's theory of electromagnetic field | |
| | **3. Oscillatory and wave processes** | 17 |
| | Topic 1. General information about oscillatory processes; free oscillations | |
| | Topic 2. Addition of harmonic oscillations; forced oscillations | |
| | Topic 3. Wave processes; elastic waves | |
| | Topic 4. Electromagnetic waves | |
| | Topic 5. The concept of alternating current. Periodic processes in AC circuits | |
| | Topic 6. Overview of light waves. The interference of light. The diffraction of light. Polarization and dispersion of light | |
| | Topic 7. Elements of quantum mechanics | |
| | **4. Molecular physics and thermodynamics** | 6 |
| | Topic 1. Elements of classical and quantum statistics | |
| | Topic 2. Fundamentals of thermodynamics | |
| | Topic 3. Elements of physical kinetics. The transport processes | |
| | Topic 4. The state of aggregation. Phase equilibrium and phase transformations | |
| | 5, **Elements of the quantum theory of radiation, atomic physics and solid state physics** | 10 |
| | Topic 1. Elements of the quantum theory of thermal radiation | |
| | Topic 2. Some quantum-optical effects | |
| | Topic 3. Physical foundations of quantum electronics. Spontaneous and stimulated radiation | |
| | Topic 4. Elements of atoms physics | |
| | Theme 5. Elements of solids theory and semiconductor physics | |
| | **6. Physics of atomic nuclei** | 4 |
| | Topic 1. The composition, binding energy of the nucleus and the static characteristics of atomic nuclei | |
| | Topic 2. The nuclear reaction. Radioactivity | |
| | Topic 3. Elements of dosimetry and physical basis of nuclear engineering | |
| | Topic 4. Fundamental particles and interactions; modern physical picture of the world | |
| | **LABORATORY CLASSES** | **75** |
| | 1. Laboratory work in physical foundations of mechanics | 10 |
| | 2. Laboratory works on electrodynamics | 20 |
| | 3. Laboratory work with oscillatory and wave processes | 12 |
| | 4. Laboratory work on molecular physics and thermodynamics | 11 |
| | 5. Laboratory work on the elements of the quantum theory of radiation, atomic physics and solid state physics | 20 |
| | 6. Laboratory work on nuclear physics | 2 |
| | **TOGETHER** | **150** |

# 6. KNOWLEDGE PROCESS TESTING

Certification of achievement of the students is done through transparent procedures based on objective criteria in accordance with the «regulations on the assessment of learning outcomes of applicants to higher education».

The attained level of competences in relation to expected identified during control activities, reflect the real result of training the student for discipline.

## 6.1. Grading Scales

Estimation of educational achievements of students of NTU «GP» is carried out on the rating (100-point) and institutional scales. The latter is necessary (for the lack of a national official scale) for conversion (translation) of the mobile students.

***Scale of assessment of educational achievements of students of NTU «GP»***

| Rating | Institutional |
|---|---|
| 90...100 | excellent / Excellent |
| 74...89 | good / Good |
| 60...73 | satisfactory / Satisfactory |
| 0...59 | unsatisfactory / Fail |

Credits of the discipline can be accepted if the student received a final grade of not less than 60 points. The lowest score is considered an academic debt, which is subject to liquidation.

## 6.2. Diagnostic Tools and Evaluation Procedures

The contents of diagnostic tools aimed at controlling the level of formation of knowledge, skills, communication, autonomy and responsibility of the student for the requirements of the NQF to the 6th level of qualification during a demonstration is regulated by the working program learning outcomes.

The student to control actions needs to perform tasks that are focused solely on the demonstration of disciplinary learning outcomes (section 2).

Diagnostic tools that are provided to students on Supervisory activities in the form of jobs for the current and final control, are generated through specification of initial data and method of demonstrating disciplinary learning outcomes.

The diagnostic tool (control tasks) for the current and final control of the discipline approved by the Department.

The types of diagnostic and evaluation procedures for current and final control of the discipline are presented below.

***Diagnostics and estimation procedure***

| INTERMEDIATE CONTROL | | | FINAL CONTROL | |
|---|---|---|---|---|
| **training session** | **diagnostic tools** | **procedures** | **diagnostics tools** | **procedures** |
| lectures | control tasjs for each topic | task during lectures | comprehensive reference work (CCW) | determining the average results of intermediate controls,<br><br>CCW performance during the examination at the request of the student; |
| laboratory works | control tasks for each topic ot individual task | tasks during practical classes | | |
| | | tasks during independent work | | |

## 6.3. Evaluation Criteria

The actual results of student learning are identificated and are measured relative to expected during control activities using criteria that describe student to demonstrate achievement of the learning outcomes.

To evaluate execution of control tasks during the current monitoring lectures and practical classes in the criterion used by the absorption coefficient, which automatically adapts the indicator to the rating scale:

$$OI = 100\ a/m,$$

where a is the number of correct answers or completed significant transactions in accordance with the standard solution; m is the total number of questions or significant operations standard.

Individual assignments and a comprehensive test papers are assessed by experts using criteria, characterizing the ratio of the level of competencies and indicators of the rating scale.

The content of the criteria is based on competence the characteristics defined for the NQF level of bachelor in higher education (see below).

***General criteria to achieve the learning outcomes for the 6th qualification level according to NQF***

**Integrated competence** – ability to solve complex tasks and problems in physics in the learning process; to carry out a heuristic evaluation of physical quantities; choose ha to competently use the adequate mathematical instrument; to be able to justify the physical model selected for the solution salac, and the limits of its application; ability to use measuring devices and evaluate measurement accuracy on the basis of the elementary theory of errors; free use English physical terminology.

| Descriptors NLC | Requirements for knowledge, skills, communication, autonomy and responsibility | Indicator evaluation |
|---|---|---|
| | ***Knowledge*** | |
| • specialized conceptual knowledge acquired in the process of learning and/or professional activities at the level of the latest achievements, which are the basis for original thinking and innovation, particularly in the context of the research<br>• critical thinking about problems in learning and /or professional activities and at the border of domains | conceptual knowledge<br>Response is excellent – right, reasonable, sensible.<br>Describes:<br>- specialized at the level of the latest achievements;<br>- critical discussion of problems in teaching and/or professional activities and at the boundary of the subject areas | 95-100 |
| | The response contains a structurally unstable errors or clerical errors | 90-94 |
| | The answer is correct, but it has some inaccuracies | 85-89 |
| | The answer is correct, but it has some inaccuracies and insufficiently substantiated | 80-84 |
| | The answer is correct, but it has some inaccuracies, insufficiently substantiated and meaningful | 74-79 |
| | The answer is a fragmentary | 70-73 |
| | The response demonstrates a fuzzy representation of the student about the study | 65-69 |
| | The level of knowledge minimally satisfactory | 60-64 |
| | The level of knowledge poor | <60 |
| | ***The ability*** | |
| • solve complex tasks and problems that require upgrading and integration of knowledge, often in conditions of incomplete/insufficient information and conflicting requirements;<br>• the implementation of research and/or innovation | Response characterizes the ability<br>- identify problems;<br>- to formulate hypotheses;<br>- to solve problems;<br>- to update knowledge;<br>- to integrate knowledge | 95-100 |
| | The response describes the ability to apply knowledge in practical activities gross errors | 90-94 |
| | The response describes the ability to apply knowledge in practice, but it has some inaccuracies when implementing one of the requirements | 85-89 |
| | The response describes the ability to apply knowledge in practice, but it has some | 80-84 |

| Descriptors NLC | Requirements for knowledge, skills, communication, autonomy and responsibility | Indicator evaluation |
|---|---|---|
| | inaccuracies with the implementation of two requirements | |
| | The response describes the ability to apply knowledge in practice, but it has some inaccuracies in the implementation of the three requirements | 74-79 |
| | The response describes the ability to apply knowledge in practice, but it has some inaccuracies in the implementation of the four requirements | 70-73 |
| | The response describes the ability to apply knowledge in practical activities when performing tasks on the model | 65-69 |
| | The response describes the ability to apply knowledge while performing tasks on the model, but with inaccuracies | 60-64 |
| | Skill level unsatisfactory | <60 |
| ***Communication*** | | |
| • a clear and unambiguous report of his findings, as well as knowledge and explanations that justify them, to specialists and non-specialists ;<br>• the use of foreign languages in the learning process | Clarity of the response (report).<br>Language:<br>- correct;<br>- clean;<br>- clear;<br>- accurate;<br>- logic;<br>- expressive;<br>- concise.<br>Communication strategy:<br>- coherent and consistent development of thought;<br>- the logical judgment;<br>- relevant argumentation and its conformity with the defended provisions;<br>- the correct structure of the answer (report);<br>- the correctness of the answers to the questions;<br>- appropriate technique of answering questions;<br>- the ability to draw conclusions and to formulate proposals;<br>- the use of foreign languages | 95-100 |

| Descriptors NLC | Requirements for knowledge, skills, communication, autonomy and responsibility | Indicator evaluation |
|---|---|---|
| | in professional activities | |
| | Sufficient clarity of the response (of the report) and relevant communication strategy with minor shortcomings | 90-94 |
| | Good clarity of the response (of the report) and relevant communication strategy (not implemented a total of three requirements) | 85-89 |
| | Good clarity of the response (of the report) and relevant communication strategy (not implemented a total of four requirements) | 80-84 |
| | Good clarity of the response (of the report) and relevant communication strategy (not implemented a total of five requirements) | 74-79 |
| | Satisfactory the clarity of the response (of the report) and relevant communication strategy (not implemented a total of seven claims) | 70-73 |
| | Satisfactory the clarity of the response (report) and communication strategy with flaws (not implemented a total of nine claims) | 65-69 |
| | Satisfactory the clarity of the response (report) and a communication strategy with the shortcomings (total not implemented 10 requirements) | 60-64 |
| | The level of communication unsatisfactory | <60 |
| ***Autonomy and responsibility*** | | |
| • responsible for the development of professional knowledge and practices, evaluation of the strategic development team;<br>• ability for further study, which is largely Autonomous and independent | Excellent command of competencies:<br>- principles and methods of organizing the activities of the team;<br>- effective distribution of powers in the structure of the team;<br>- support balanced relationships with team members (responsible for relations);<br>- resistance to stress; | 95-100 |

| Descriptors NLC | Requirements for knowledge, skills, communication, autonomy and responsibility | Indicator evaluation |
|---|---|---|
| | - self-regulation;<br>- labour activity in extreme situations;<br>- high level personal relationship to the case;<br>- possession of all types of training activities;<br>- the appropriate level of fundamental knowledge;<br>- should the level of formation general educational abilities and skills | |
| | Fluency competences autonomy and responsibility with minor shortcomings | 90-94 |
| | Good possession of competences autonomy and responsibility (not implemented two requirements) | 85-89 |
| | Good possession of competences autonomy and responsibility (not implemented three requirements) | 80-84 |
| | Good possession of competences autonomy and responsibility (four requirements) | 74-79 |
| | Satisfactory possession of competences autonomy and responsibility (not implemented five requirements) | 70-73 |
| | Satisfactory possession of competences autonomy and responsibility (not implemented six requirements) | 65-69 |
| | Satisfactory possession of competences autonomy and responsibility (level fragmented) | 60-64 |
| | The level of autonomy and responsibility unsatisfactory | <60 |

## 7. TOOLS, EQUIPMENT AND SOFTWARE

Lecture demonstration experiments. (about 150)
Physical Laboratory Workshop (about 70 papers)
Technical training (multimedia projector, computer lab work).
Moodle remote platform.

## 8. RECOMMENDED BIBLIOGRAPHY


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Educational edition

WORK PROGRAM OF THE ACADEMIC DISCIPLINE
**«Physics 1»** for bachelors
185 **«Oil and Gas Engineering and Technology»**

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