SYLLABUS OF THE ACADEMIC DISCIPLINE
«General Physics»

Academic degree	Bachelor
Academic program	141 Electrical engineering and electromechanics
Period of study	1st semester, 1st & 2st quarters
lecture:	3 hours
laboratory work:	2 hours 1st quarter 1 hour 2st quarter
Type of final assessment	graded test
Period of study	2nd semester, 3st & 4st quarters
lecture:	2 hours
laboratory work:	1 hour
Type of final assessment	exam
Language of study	English

Department Physics
Consultations: 2:30 PM - 3:50 PM, every Thursday (except holidays), room. 2/28
Online-consultations *: Microsoft Teams

Lecturers:

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1. Course annotation

Physics as an educational discipline, safe knowledge of the student about the basics of power and field, study of methods and methods of obtaining reliable data about the physical properties of things, construction materials and the dependence of their properties on changes in the environment; determination of the main characteristics and methods of determination of mechanical, thermal, electrical, magnetic and optical forces arising both at macro- and microscopic levels.

2. Discipline objectives

The objective of discipline – formation acquirers of competencies, skills and knowledge in the field of physics regarding fundamental concepts, laws and theories of classical and modern physics, which provides them with effective mastery of special disciplines and the further possibility of using physical principles in the field of electrical engineering.

Course objectives: the main tasks when studying the discipline "General Physics" is to give students a sufficiently broad theoretical training in the field of physical properties of substances and materials, which would allow future specialists to navigate the flow of scientific and technical information and provide them with the opportunity to use the latest physical principles in their work;

– a scientific thinking form in students, a correct understanding of the limits of the application of various physical concepts, theories and the ability to assess the degree of reliability of the results obtained with the help of experimental or mathematical research methods;

– to acquaint students with modern scientific equipment and to develop in them the initial skills of conducting experimental research in order to identify certain characteristics of the object under study;

– promote the development of students' physical thinking and dialectical outlook;

– to acquaint students with the history of physical science and the role of domestic scientists in the development of physics.

3. Learning outcomes

As a result of studying the academic discipline, the student should know:

– basic physical laws and formulas describing physical processes;

– basic physical constants and their scope to use;

– principle of operation of the main measuring devices;

– methods of obtaining the necessary experimental data.

be able:

– give meaning to basic concepts and physical phenomena;

– characterize the physical properties of substances and know the descriptors for their distinction;

– make equations of simple physical movements and processes;

– perform basic physical calculations and simple physical measurements: mass, temperature, density, viscosity, voltage and current, frequency, lighting, radiation dose, etc.;

– apply acquired knowledge to solve specific technical or research tasks.

Having mastered the course of general physics, students of the indicated field of training must know with full understanding the fundamental laws of physics and methods of their research, as well as be able to apply this knowledge when considering individual phenomena, use their physical essence; to be able to combine macroscopic phenomena with their microscopic mechanism; to be able to use the knowledge from the course of general physics when studying other disciplines, both general and specialized.

4. The structure of the course

LECTURES
1 Physical foundations of mechanics
1.1. Introduction to mechanics.

1.2. Elements of kinematics.
1.3. Dynamics of a material point and translational motion of a rigid body. Forces in mechanics.
1.4. Dynamics of a rigid body that has a fixed axis of rotation.
1.5. Conservation laws.
1.6. Elements of special relativity
2 Electrodynamics
2.1. General information about the electrostatic field. Electrostatic field in vacuum.
2.2. Electrostatic field in matter.
2.3. Direct electric current.
2.4. Electric current in gases.
2.5. A constant magnetic field in a vacuum.
2.6. The effect of a magnetic field on moving charges and a current-carrying conductor.
2.7. Magnetic field in matter.
2.8. The phenomenon of electromagnetic induction.
2.9. Fundamentals of Maxwell's theory for the electromagnetic field
3. Oscillatory and wave processes
3.1. General information about oscillating processes, free oscillations.
3.2. Addition of harmonic oscillations, forced oscillations.
3.3. Wave processes, elastic waves.
3.4. Electromagnetic waves.
3.5. The concept of alternating current. Periodic processes in alternating current circuits.
3.6. General information about light waves. Interference of light. Diffraction of light. Polarization and dispersion of light.
3.7. Elements of quantum mechanics.
4. Molecular physics and thermodynamics
4.1. Elements of classical and quantum statistics.
4.2. Fundamentals of thermodynamics.
4.3. Elements of physical kinetics. Transfer processes.
4.4. Aggregate states. Phase equilibrium and phase transformations.
5. Elements of quantum theory of radiation, atomic physics and solid state physics
5.1. Fundamentals of quantum theory of thermal radiation.
5.2. Some quantum optical effects.
5.3. Physical foundations of quantum electronics. Spontaneous and forced radiation.
5.4. Elements of atomic physics.
5.5. Elements of band theory of solids and semiconductor physics.
6. Physics of the atomic nucleus
6.1. Composition, binding energy of the nucleus and static characteristics of atomic nuclei.
6.2. Nuclear reactions. Radioactivity.
6.3. Elements of dosimetry and physical bases of nuclear energy.
6.4. Fundamental particles and interactions; modern physical picture of the world.
PRACTICAL TRAINING
1. Laboratory work on the physical foundations of mechanics
2. Laboratory work on electrodynamics
3. Laboratory work on oscillatory and wave processes
4. Laboratory works on molecular physics and thermodynamics

5. Laboratory work on elements of quantum theory of radiation, atomic physics and solid state physics
6. Laboratory work on atomic nucleus physics

6. Grading scales and requirements

6.1. The educational achievements of higher education applicants based on the results of the course will be evaluated according to the scale given below:

Rating	Institutional
90 – 100	Excellent
75-89	Good
60-74	Satisfactory
0-59	Fail

6.2. Applicants for higher education can receive a **final grade** in the academic discipline based on the current assessment of knowledge, provided that the number of points obtained from the current test and independent work is more than 60 points.

Maximum rating:

Theoretical part	Laboratory part		Bonus	All
	With assembly in time	With assembly untime		
60	36	26	4	100

Laboratory works are accepted if there are reports on control questions for each of the works.

The theoretical part is evaluated based on the results of passing the exam ticket, which contains 4 questions, each worth 15 points.

6.3. Evaluation criteria of the final work

The work must contain detailed answers to three questions on the ticket. If the work is performed remotely, the ticket number is issued through the MS Teams system in the communication group specified by the teacher. In this mode, the completed work is written by hand, photographed and sent to the teacher's e-mail within the time set by the teacher. An answer sent late is considered as not submitted. Points are awarded for each question:

15 points – the answer fully corresponds to the question, contains the necessary explanations and drawings, is written concisely, consistently and competently, and also contains a situational analysis;

12 points – the answer fully corresponds to the question, but some explanations are missing or a slight inaccuracy is allowed, or there is no consistency in the answer;

9 points – the answer basically reflects the essence of the question, but several inaccuracies were made or part of it does not correspond to the question, or the answer is schematic without the necessary explanations;

6 points – the answer is incomplete and contains a serious error or most of the answer is not related to the topic of the question;

3 points – the answer is incomplete and contains only general data of the content of the question, or several serious mistakes were made in the answer;

0 points – there was no answer to the question or the answer was not relevant to the question.

6.4. Criteria for evaluating laboratory work

For each laboratory work, the student of higher education receives questions from the list of control questions. The number of correct answers determines the number of points received.

7. Course policy

7.1. Academic Integrity Policy.

Academic integrity of students is an important condition for mastering the results of training in the discipline and obtaining a satisfactory grade on the current and final tests. Academic integrity is based on condemnation of the practices of copying (writing with external sources other than those allowed for use), plagiarism (reproduction of published texts by other authors without indication of authorship), fabrication (fabrication of data or facts used in the educational process). The policy on academic integrity is regulated by the Regulation "Regulations on the system of prevention and detection of plagiarism at the Dnipro University of Technology (http://www.nmu.org.ua/ua/content/activity/us_documents/System_of_prevention_and_detection_of_plagiarism.pdf.)

In case of violation of academic integrity by a student (copying, plagiarism, fabrication), the work is evaluated unsatisfactorily and must be repeated. The teacher reserves the right to change the topic of the task.

7.2. Communication policy.

Students must have activated university mail.

All written questions to teachers regarding the course should be sent to the university e-mail.

7.3. Reassembly policy.

Works that are submitted in violation of deadlines without good reason are evaluated at a lower grade. Relocation takes place with the permission of the dean's office if there are good reasons (for example, sick leave).

7.4. Attending classes.

Full-time students are required to attend classes. Good reasons for not attending classes are illness, participation in university events, business trips, which must be confirmed by documents in case of prolonged (two weeks) absence. The student must inform the teacher either in person or through the headmaster about the absence from class and the reasons for absence. If a student is ill, we recommend staying home and studying with a distance platform. Students whose health is unsatisfactory and may affect the health of other students will be encouraged to leave the class (such absence will be considered an absence due to illness). Practical classes are not repeated; these assessments cannot be obtained during the consultation. For objective reasons (for example, international mobility), learning can take place remotely - online, in agreement with the teacher.

7.5 Evaluation Appeal Policy.

If the student does not agree with the assessment of his knowledge, he may appeal the assessment made by the teacher in the prescribed manner.

7.6. Bonuses

At the end of the course and before the start of the higher education applicant session, you will be asked to anonymously fill out electronic questionnaires (Microsoft Forms Office 365), which will be sent to your university mailboxes. Filling out questionnaires is an important component of your educational activity, which will allow you to evaluate the effectiveness of the applied teaching methods and take into account your suggestions for improving the content of the "Physics" educational discipline. For participation in the questionnaire, the applicant of higher education receives **4 points**.

8 Recommended bibliography

Principal

1. Lecture notes for General Physics / Martin Kruczenski.-Department of Physics, Purdue University, 507p., 2016
2. College Physics for AP Courses /Irina Yablinska and other .- Texas Education Agency
3. Texas,USA , 850p., 2015
4. College Physics for AP Courses 2e / Irina Yablinska and other .- Texas Education Agency
5. Texas, USA , 890p., 2022
6. Bercley Physics Course. / .-- Libruary of Congress , USA, 954p., 2018
7. Universiny physics with modern physics/ Hugh D. Young, Hugh D.— San Francisco , USA, 1598 p., 2012
8. Physics / Paul Peter Uron and other.- Texas Education Agency, Texas,USA , 850p., 2020
9. University Physics Volume 1, 2, 3/ Samuel J. Ling fnd other .- Texas Education Agency
10. Texas,USA , 2390 p., 2016
11. English-Ukrainian Encyclopedic Dictionary of general definitions. Concepts and Laws from Physics / Іри-на Мороз. -Львів: Видавництво Львівської політехніки, 362с., 2020

Additional

1. Кучерук І.М., Горбачук І.Т., Луцік П.П. Загальний курс фізики, – Київ. Тех-ніка. – 1999 - 2004, т.1, 2, 3.
2. Курс фізики (під редакцією Лопатинського І.Є.). – Львів. – ”Бескід Біт”. – 2002.
3. Бушок Г.Ф., Левандовський В.В., Півень Г.Ф.. Курс фізики. У 2 кн.: Кн.1. Фізичні основи механіки. Електрика і магнетизм. – К.:«Либідь», 2001. – 448с. Бушок Г.Ф., Венгер Е.Ф. Курс фізики. Кн.2. Оптика. Фізика атома і атомного ядра. Молекулярна фізика і термодинаміка. К. «Либідь»2001. – 422 с.
4. Курс загальної фізики. Навчальний посібник для вищих навчальних закладів. / КармазінВ.В., Семенець В.В.-К.: Кондор, 2016.-786 с
5. Бойко В.В., Булах В.І., Гуменюк Я.О., Ільїн П.П. Фізика. Підручник для вищих навчальних закладів. К.: Ліра-К, 2016. 468 с.
6. Фізика. Ч.1. Механіка. Молекулярна фізика та термодинаміка. Електрика.: Підручник для вищих навчальних закладів / В.В. Бойко, Г.О.Сукач, В.В. Кідалов. – К.: Видавництво ПРОФІ , 2016. – 371 с.

7. Фізика. Ч.2. Магнетизм. Оптика. Елементи квантової фізики, фізики твердого тіла, атома та ядра: Підручник для вищих навчальних закладів / В.В. Бойко, Г.О.Сукач, В.В. Кідалов. – К.: Видавництво ПРОФІ , 2016. – 319 с.
8. Лопатинський І.Є, Зачек І.Р., Юр'єв С.О. та ін. Збірник задач з фізики / Навч. посібник. – Львів: Вид-во Львівської політехніки, 2016. – 244 с.
9. Янг Г., Фрідман Р. Фізика для університетів. Львів, Наутілус. 2018. 1516 с.
10. Електрика та магнетизм : підручник / Л. Д. Дідух. — Тернопіль : Підручники і посібники, 2020. — 464 с.
11. Фізика. Механіка, молекулярна фізика та термодинаміка : навчальний посібник / Ю. О. Шкурдода, О. О. Пасько, О. А. Коваленко. – Суми : Сумський державний університет, 2021. –221 с.
12. Гаркуша І.П., Горбачук І.Т., Курінний В.П. та ін. Загальний курс фізики: Збірник задач – К.: «Техніка», 2004,– 560 с.
13. Гаркуша І.П., Курінний В.П. Фізика. Навчальний посібник у 7 частинах. Д.: Дніпровська політехніка, 2015-2018, 580 с. (Ч. 1. Механіка. Ч.2. Молекулярна фізика і термодинаміка. Ч.3. Електрика і магнетизм. Ч.4. Коливання і хвилі. Ч.5. Хвильова оптика. Ч.6. Квантова фізика. Ч.7. Фізика атомного ядра і елементарних частинок.)
14. Гаркуша І.П., Курінний В.П., Мостіпан Л.Ф. Фізика. Навчальний посібник для самостійної роботи студентів. – Дніпропетровськ: НГУ. 2011.
15. Гаркуша І.П., Мокляк З.П., Буслов Ю.О. Фізика. Задачі з розв'язаннями. – Дніпропетровськ. НГУ.2003.
16. Гаркуша І.П. Елементи фізики напівпровідників. Навчальний посібник: - Д.: Національний технічний університет «Дніпровська політехніка», 2022. – 80 с.
17. Певзнер М.Ш. Основи теорії відносності: навч. посіб. Дніпропетровськ: НГУ, 2013. 134 с.