SYLLABUS OF THE ACADEMIC DISCIPLINE
«GENERAL PHYSICS»

Academic degree	Bachelor
Specialty	141 Electrical energetics, electrical engineering and electromechanics
Academic program	Electrical energetics, electrical engineering and electromechanics
Period of study	1, 2 semesters (1-4 terms)
Total workload	11 credits ECTS (330 hours)
Classroom workload:	
lectures:	3 hours (1, 2 terms), 2 hours (3, 4 terms)
laboratory works:	2 hours (1, 3 terms), 1 hour (2, 4 terms)
Language of study	English

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

Instructor:
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1. About this course

Physics, as an academic course, provides students with a deepening of their knowledge of the basic properties of matter and field, mastering methods and techniques for obtaining reliable data on the physical properties of substances, structural materials and the dependence of their properties on environmental changes, mastering the basic characteristics and methods of measuring mechanical, thermal, electrical, magnetic and optical properties of substances at both macro and microscopic levels.

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 courses, both general and specialized.

2. Aim and objectives

The aim of the course – 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 task when studying the course "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

Disciplinary learning outcomes:

– analyze the results of observations and experiments using the basic laws of physics, use physical devices;

– to analyze physical mechanisms that are essential when considering processes in electric power, electrotechnical and electromechanical equipment, relevant complexes and systems;

– formation of abilities to generalize, analyze, perceive information, set a scientific problem and choose a way to solve it;

– formulate physical ideas, solve problems, estimate quantities, operate physical models and be aware of the limits of their applications;

– apply knowledge of the basic fundamental laws of classical and modern physics to solve electrical engineering problems;

– correctly reproduce physical ideas and correctly apply the principles and laws of physics for the analysis and synthesis of electromechanical and electric power systems with specified indicators.

4. Course program

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

5. Technical equipment and/or software

Specialized equipment is used for conducting demonstration experiments during lectures, physical laboratory workshops on specialized stands, computer laboratory work, multimedia equipment, and the remote platform Moodle.

6. Evaluation system and requirements

6.1. The academic achievements of higher education applicants based on the results of the completion of the course will be evaluated on the scale below:

Rating	**Institutional**
90 – 100	Excellent
74 – 89	Good
60 – 73	Satisfactory
0 – 59	Fail

The general criteria for achieving the learning outcomes correspond to the descriptions of the 6th qualification level of the NQF.

6.2. Applicants for higher education can receive **a final grade** in this course based on the formative assessment of their knowledge, provided that the total number of points gained from the formative testing and the performance and defense of laboratory works is at least 60 points.

The maximum number of points for the formative assessment:

Theoretical part	Laboratory part		Bonus	Total
	in time turn-ins	late turn-ins		
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 for 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 works. For each laboratory work, the applicant for 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. Policy on academic integrity. The academic integrity of higher education applicants is an important condition for mastering the learning outcomes of the course and obtaining satisfactory grades in formative and summative assessments. Academic integrity is based on the condemnation of the practices of cheating (writing with the involvement of external sources of information other than those authorized for use), plagiarism (reproduction of published texts of other authors without proper attribution), fabrication (inventing data or facts used in the educational process). The policy on academic integrity is regulated by the Regulation on system of prevention and detection of plagiarism at the Dnipro University of Technology (https://www.nmu.org.ua/ua/content/activity/us_documents.pdf).

If a higher education applicant violates academic integrity (cheating, plagiarism, fabrication), the assignment is graded unsatisfactory and must be repeated. In this case, the instructor reserves the right to change the topic of the assignment.

7.2. Communication policy. Applicants for higher education must have an activated corporate university email.

All written questions to the instructors regarding the course should be sent to the university email.

7.3. Policy on retakes. Assignments that are submitted late without valid reasons will be evaluated at a lower grade. Retakes of the summative assessment are allowed with the permission of the dean's office if there are valid reasons (e.g., sick leave).

7.4. Class attendance. Attendance at classes is mandatory for full-time applicants for higher education. Valid reasons for absence from classes are illness, participation in university events, and academic mobility, which must be confirmed by documents. A higher education applicant must notify the instructor either personally or through the leader of the academic group about the absence from class and the reasons for the absence.

If a course learner is ill, it is recommended that he or she stays at home and studies in the E-learning platform of DniproTech. Learners whose health condition is unsatisfactory and may affect the health of others will be asked to leave the class (such absence will be considered as an absence due to illness).

Practical classes are not repeated; these activities cannot be completed during the consultation.

For objective reasons (e.g. international mobility), studies may take place online with the consent of the course instructor.

7.5 Evaluation appeal policy. If a higher education applicant does not agree with the evaluation of his/her knowledge, he/she may appeal the grade assigned by the instructor in a prescribed manner.

7.6. Bonuses. Upon completion of the course and before the start of the examination period, the applicant for higher education will be asked to anonymously fill out electronic questionnaires (Microsoft Forms Office 365), which will be sent to your university mailboxes. Filling out the questionnaires is an important component of your learning activity, which will allow us to evaluate the effectiveness of the applied teaching methods and consider your suggestions for improving the content of the course "General Physics". For participation in the survey and/or in scientific work, and conferences, the applicant for higher education receives **4 points**.

8. Recommended readings

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, – Киів. 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.