



Syllabus Course Program

Physics

Specialty

113 - Applied mathematics

Institute

Institute of Computer Modelling, Applied Physics and Mathematics

Educational program

Computer and mathematical modelling

Department

Physics (168)

Level of education

Bachelor's degree

Course type

General, Compulsory

Semester

1

Language of instruction

English

Lecturers and course developers

**Olga Vodoriz**

Olga.Vodoriz@khpi.edu.ua

PhD in Physics and Mathematics, Associate Professor of the Department of Physics (NTU 'KhPI')

Author of more than 90 scientific and educational publications.

Courses: 'Physics', "Physics CHI", "Physics CHII", "Physics".

[More about the lecturer on the department's website](#)

General information

Summary

The physics course introduces the fundamental concepts, laws and theories of classical and modern physics, the basic methods of solving physical problems, and the peculiarities of physical processes. This will ensure effective mastery of specialised disciplines and the subsequent ability to use physical principles in professional activities. Through the study of basic laws and phenomena, students will acquire the skills of practical application of physical laws, analysis and generalisation of the results of physical experiments to use them in the field of chemical technology.

Course objectives and goals

The aims of the course are to provide future graduates with basic knowledge of physics; to develop skills of understanding the physical content of engineering problems; to develop the ability to apply fundamental knowledge of physics in practice for the speciality of applied mathematics.

Format of classes

Lectures, practical classes, independent work, consultations.
The final control is an exam.

Competencies

GC03. Ability to generate new ideas (creativity).

GC05 Ability to conduct research at the appropriate level.

Learning outcomes

PLO07. To be able to conduct practical research and find solutions to incorrect problems.

Student workload

The total volume of the discipline is 120 hours (4 ECTS credits): lectures - 32 hours, practical classes - 16 hours, independent work - 72 hours.

Course prerequisites

Complete general secondary education

Features of the course, teaching and learning methods, and technologies

Lectures are conducted interactively with the use of multimedia technologies. In practical classes, problem-based learning, teamwork, and student feedback are used.

Program of the course

Topics of the lectures

Topic 1. Introduction to the course.

Topic 2. Elements of particle kinematics.

Topic 3. Dynamics of a material point.

Topic 4. Solid body in mechanics and laws of its motion. Work and energy.

Topic 5. Mechanical vibrations and waves.

Topic 6. Fundamentals of molecular physics and thermodynamics.

Topic 7. Electrostatics in a vacuum.

Topic 8. Conductors and dielectrics in an electrostatic field. Direct electric current.

Topic 9. Magnetostatics in a vacuum.

Topic 10. Magnetic field in matter. Electromagnetic induction.

Topic 11. Electromagnetic oscillations and waves.

Topic 12. Wave optics.

Topic 13. Elements of quantum optics.

Topic 14. Substantiation of the basic ideas of quantum theory.

Topic 15. Quantum mechanics and the corpuscular-wave dualism of matter. Quantum state. Schrödinger's equation.

Topic 16. The atomic nucleus.

Topics of the workshops

Topic 1. Kinematics of translational and rotational motion.

Topic 2. Dynamics of translational and rotational motion. Laws of conservation.

Topic 3. Mechanical vibrations and waves.

Topic 4. Fundamentals of molecular physics and thermodynamics.

Topic 5. Electrostatics in vacuum and medium. Direct electric current.

Topic 6. Magnetostatics in a vacuum. Electromagnetic induction.

Topic 7. Wave optics.

Topic 8. Laws of thermal radiation. Bohr's postulates. The atomic nucleus.

Topics of the laboratory classes

Laboratory work within the discipline is not provided

Self-study

Students are recommended additional materials (manuals, guidelines) for independent work.

Course materials and recommended reading

Main literature

1. Gapochenko S.D. Mechanics. Study guide for independent work in the discipline 'Physics' / Gapochenko S.D. Kharkiv: V Sprave LLC, 2021. 116 p. <http://repository.kpi.kharkov.ua/handle/KhPI-Press/53032>.
2. Gapochenko S.D. Mechanical vibrations and waves [Electronic resource]: reference lecture notes in the discipline 'Physics': for students of technical specialties / S.D. Gapochenko ; National Technical University 'Kharkiv Polytechnic Institute.' - Electronic text data. - Kharkiv, 2021. - 49 p. : ill. - Presented in the form of a presentation. - <https://repository.kpi.kharkov.ua/handle/KhPI-Press/56830>.
3. Physics. Study guide for distance learning / N.B. Fatianova, T.M. Shelest, I.V. Galushchak, Yu. Menshov - Kharkiv: NTU 'KhPI', 2021. 164 p. <http://repository.kpi.kharkov.ua/handle/KhPI-Press/49895>.
4. Optics, Atomic and Nuclear Physics [Electronic resource]: a textbook / O. S. VodORIZ, O. A. Liubchenko, T. V. Tavrina. Tavrina ; National Technical University 'Kharkiv Polytechnic Institute.' - Electronic text data - Kharkiv, 2021. 159 p. - URI: <http://repository.kpi.kharkov.ua/handle/KhPI-Press/54012>.

Additional literature

1. Methodical instructions for independent work on the topic 'Mechanics. Part 1. Kinematics' for the course "Physics" for students of all specialties / compiled by: Khramova T.I., Kryvonis S.S., Shelest T.M. - Kharkiv: NTU 'KhPI', 2020. 36 p. <http://repository.kpi.kharkov.ua/handle/KhPI-Press/49380>.
2. Methodical instructions for independent work on the topic 'Mechanics. Part 2. Dynamics' from the course "Physics" for students of technical specialties / compiled by: Khramova T.I., Kryvonis S.S., Shelest T.M. Kharkiv: NTU 'KhPI', 2021. - 48 p. <http://repository.kpi.kharkov.ua/handle/KhPI-Press/53080>.
3. Methodical instructions for independent work on the topic 'Mechanical vibrations and waves' in the course 'Physics' : for students of technical specialties / compiled by T. I. Khramova, S. S. Kryvonis, T. M. Shelest ; National Technical University 'Kharkiv Polytechnic Institute.' - Kharkiv: Printing House Madrid, 2022. 60 p. <https://repository.kpi.kharkov.ua/handle/KhPI-Press/55943>.
4. Physics. Mechanics, molecular physics and thermodynamics: a textbook / Y. Shkurdoda, O. Pasko, O. Kovalenko - Sumy: Sumy State University, 2021. 221 p. <https://essuir.sumdu.edu.ua/handle/123456789/83976>.
5. Shkurdoda Y. O. Physics. Electricity and magnetism [Electronic resource]: a textbook / Y. Shkurdoda, O. Pasko, I. Shpetnyi - Sumy State University: SumDU, 2022. 172 p. <https://essuir.sumdu.edu.ua/handle/123456789/90010>.
6. Optics, atomic and nuclear physics: a guide to solving problems [Electronic resource]: a study guide / O. S. VodORIZ, O. A. Liubchenko, T. V. Tavrina. Tavrina ; National Technical University 'Kharkiv Polytechnic Institute.' - Electronic text data - Kharkiv, 2021. 172 p. - URI: <http://repository.kpi.kharkov.ua/handle/KhPI-Press/54001>.

Assessment and grading

Criteria for assessment of student performance, and the final score structure

Independent work (30 points)
Test papers (30 points)
Colloquium (20 points)
Exam (20 points)

Grading scale

Total points	National	ECTS
90-100	Excellent	A
82-89	Good	B
75-81	Good	C
64-74	Satisfactory	D
60-63	Satisfactory	E
35-59	Unsatisfactory (requires additional learning)	FX
1-34	Unsatisfactory (requires repetition of the course)	F

Norms of academic integrity and course policy

The student must adhere to the Code of Ethics of Academic Relations and Integrity of NTU "KhPI": to demonstrate discipline, good manners, kindness, honesty, and responsibility. Conflict situations should be openly discussed in academic groups with a lecturer, and if it is impossible to resolve the conflict, they should be brought to the attention of the Institute's management.

Regulatory and legal documents related to the implementation of the principles of academic integrity at NTU "KhPI" are available on the website: <http://blogs.kpi.kharkov.ua/v2/nv/akademichna-dobrochesnist/>

Approval

Approved by

Date, signature

Head of the department
Vyacheslav BURLAENKO

Date, signature

Guarantor of the educational program
Gennadiy LVOV