Syllabus
Course Program

PHYSICS (part 2)

Specialty
161 Chemical technologies and engineering

Institute
Institute of Computer Modeling, Applied Physics and Mathematics

Educational program
Technology of oil, gas and solid fuel refining

Department
Physics (168)

Level of education
Bachelor's level

Course type
Special (professional), Mandatory

Semester
2

Language of instruction
English

Lecturers and course developers

Olga Vodoriz

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Candidate of physical and mathematical sciences (PhD), Associate Professor of the Physics Department.
Author of more than 90 scientific and educational publications.
Lecturer in the courses "Physics".

More about the lecturer on the department's website

General information

Summary

The course of physics acquaints with the fundamental concepts, laws and theories of classical and modern physics, the basic methods of solving physical problems, and the features of physical processes. This will ensure the effective mastery of special disciplines and further possibility of using physical principles in professional activity in the field of chemical technologies. The course covers the following sections of physics as a fundamental discipline that forms a complete picture of the modern world: magnetism, optics, quantum physics and quantum mechanics, nuclear physics and solid state physics. During the study of basic laws and phenomena, students acquire skills of learning the laws of physics in practice, summarize and analyze the results of physical experiments to apply in the field of chemical technologies.

Course objectives and goals

The goals of the course are to provide future graduates with basic knowledge of physics; to form the skills of understanding the physical content of engineering problems; to develop the ability to practically apply fundamental knowledge of physics for the specialty of chemical technologies and engineering.

Format of classes

Lectures, laboratory classes, self-study, consultations.
Final assessment is an exam.

Competencies

C01. Ability to abstract thinking, analysis and synthesis.
C02. Ability to apply knowledge in practical situations.

Learning outcomes

PR01. Know mathematics, physics and chemistry at the level necessary to achieve the results of the educational program.

Student workload

The total volume of the course is 120 hours (4 ECTS credits): lectures - 32 hours, laboratory classes - 16 hours, self-study - 72 hours.

Course prerequisites

To successfully learn the course, you must have knowledge and practical skills from the course "Physics. Part 1"

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

Lectures are conducted interactively using multimedia technologies. Laboratory classes use problem-based learning, teamwork, feedback method from students.

Program of the course

Topics of the lectures

Topic 1. Magnetostatics in a vacuum.
Topic 2. Magnetic field in matter.
Topic 3. Electromagnetic induction. Basics of Maxwell's theory for the electromagnetic field.
Topic 4. Electromagnetic oscillations and waves.
Topic 5. Interference of light.
Topic 6. Diffraction of light.
Topic 7. Elements of quantum optics.
Topic 8. Rationale of the main ideas of quantum theory.
Topic 9. Quantum mechanics and particle-wave dualism of matter. Quantum state. Schrödinger's equation.
Topic 10. Atom.
Topic 11. Atomic nucleus.
Topic 12. Crystals.
Topic 13. Concept of zone theory of solids.
Topic 14. Electrical conductivity of matter.
Topic 15. The concept of the elementary particles physics and the modern physical picture of the world.

Topics of the workshops

Workshops works are not provided within the discipline

Topics of the laboratory classes

Topic 1. Magnetism.
Topic 2. Wave optics.
Topic 3. Quantum optics.
Topic 4. Quantum mechanics.
Topic 5. Physics of the atomic nucleus.
Topic 6. Solid state physics.

Self-study

Students are recommended additional materials (lecture notes, laboratory manuals) for independent work.

Course materials and recommended reading

Compulsory materials
1. Lyubchenko O. A. Magnetism : lecture notes - Kharkiv : NTU "KhPI", 2022. - 29 p. URL: http://web.kpi.kharkov.ua/tef/educational-material-in-english-ua/
2. Lyubchenko O. A. Electromagnetic oscillations: study guide - Kharkiv : NTU "KhPI", 2022. - 24 p. URL: http://web.kpi.kharkov.ua/tef/educational-material-in-english-ua/
3. Lyubchenko O. A. Wave optics: study guide - Kharkiv : NTU "KhPI", 2022. - 54 p. URL: http://web.kpi.kharkov.ua/tef/educational-material-in-english-ua/
4. Lyubchenko O. A. Quantum optics: study guide - Kharkiv : NTU "KhPI", 2022. - 42 p. URL: http://web.kpi.kharkov.ua/tef/educational-material-in-english-ua/
5. Lyubchenko O. A. Atomic and nuclear physics: study guide - Kharkiv : NTU "KhPI", 2022. - 46 p. URL: http://web.kpi.kharkov.ua/tef/educational-material-in-english-ua/
6. Lyubchenko O. A. – Physics. Laboratory manual. - Kharkiv : NTU "KhPI", 2022. - 62 p. URL: http://web.kpi.kharkov.ua/tef/educational-material-in-english-ua/

Additional materials
1. College Physics for AP® Courses 2ed (2022) by OpenStax https://openstax.org/details/books/college-physics-ap-courses-2e?Book%20details
2. Foundations of Physics by Terrance Berg (2023) https://opentextbc.ca/foundationsofphysics/
3. Douglas College Physics 1104 (Summer 2021) by Department of Physics and Astronomy at Douglas College and OpenStax https://pressbooks.bccampus.ca/douglasphys1104summer2021/
4. https://openlearning.mit.edu/courses-programs/open-learning-library?f%5B0%5D=open_moocs_departments%3A34
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Assessment and grading

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

Exam: oral presentation.
Current assessment: laboratory work (40 points), calculation assignment (60 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	30.08.2023		Head of the department Olena LYUBCHENKO
	30.08.2023		Guarantor of the educational program Iryna SENKEVYCH