Syllabus
Course Program

Physics

Specialty
121 – Software Engineering

Institute
Institute of Computer Modeling, Applied Physics and Mathematics

Educational program
Software Engineering

Department
Physics (168)

Level of education
Bachelor's level

Course type
General, Mandatory

Semester
1

Language of instruction
English, Ukrainian

Lecturers and course developers

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Author of more than 90 scientific and educational publications.
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More about the lecturer on the department's website

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Author of more than 120 scientific and educational publications.
Lecturer in the courses "Physics" and "General 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. The course covers all sections of physics as a fundamental discipline that forms a holistic picture of the modern world. 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 software engineering.

Course objectives and goals

The aim of the course is to provide future software engineers with a base knowledge of physics; to form students' skill of understanding the physical content of problems; to develop students' ability to practically apply fundamental knowledge of physics in the field of software engineering.

Format of classes

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

Competencies

К01. Ability to think abstractly, analyze and synthesize.
К05. Ability to learn and master modern knowledge.
К06. Ability to search, process and analyze information from various sources.
К20. Ability to apply fundamental and interdisciplinary knowledge to successfully solve software engineering problems.

Learning outcomes

PLO01. Analyze, purposefully search and select information and reference resources and knowledge necessary for solving professional problems, taking into account modern achievements of science and technology.

Student workload

The total volume of the course is 120 hours (4 ECTS credits): lectures - 48 hours, practical classes - 16 hours, self-study - 56 hours.

Course prerequisites

To successfully learn the course, you must have knowledge and practical skills from the courses "Physics", "Algebra and the beginnings of analysis" in the scope provided by the programs of general secondary schools

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

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

Program of the course

Topics of the lectures

Topic 1. Elements of particle kinematics.
Topic 2. Dynamics of material point and a solid body
Topic 3. Work and energy
Topic 4. Mechanical oscillations
Topic 5. Wave processes

Topic 6. Fundamentals of molecular kinetic theory of gases
Topic 7. Classic statistical distributions
Topic 8. Fundamentals of thermodynamics
Topic 9. Electricity
Topic 10. Magnetism
Topic 11. Electromagnetic oscillations
Topic 12. Electromagnetic waves
Topic 13. Geometric optics
Topic 14. Interference and diffraction of light
Topic 15. Electromagnetic waves in matter
Topic 16. Elements of quantum optics
Topic 17. Basic concepts of quantum physics
Topic 18. Quantum mechanics
Topic 19. Physics of atom
Topic 20. Physics of atomic nucleus
Topic 21. Elements of condensed matter physics
Topic 22. The concept of band theory of solids
Topic 23. The conductivity of the substance
Topic 24. The concept of particle physics and the modern physical picture of the world

Topics of the workshops

Topic 1. Kinematics and dynamics
Topic 2. Mechanical oscillations and waves
Topic 3. Molecular physics and thermodynamics
Topic 4. Electricity
Topic 5. Magnetism
Topic 6. Optics
Topic 7. Atomic and Nuclear Physics
Topic 8. Condensed matter physics

Topics of the laboratory classes

Laboratory works are not provided within the discipline

Self-study

The course requirements involve fulfilment of individual calculation and graphic assignment. Results must be represented as a written report. Students are also recommended educational material (lecture notes; problem solving guide) for self-study.

Course materials and recommended reading

Compulsory materials
1. Lyubchenko O. A. Mechanics : [study guide] = Механіка : навч.-метод. посібник / O. A. Lyubchenko. – Kharkiv : NTU "KhPI", 2016. – 324 p. – Engl. lang. URI: https://repository.kpi.kharkov.ua/handle/KhPI-Press/26411
2. Lyubchenko O. A. Mechanics. Oscillations and waves : Конспект лекций по курсу "Физика" на англ. яз. / Е. А. Любченко, А. Ю. Гребенник ; Нац. техн. ун-т "Харьк. политехн. ин-т". - Х. : НТУ "ХПИ", 2006. - 51 p. URL: http://web.kpi.kharkov.ua/tef/educational-material-in-english-ua/
3. Lyubchenko O. A. Electricity and magnetism : Конспект лекций по курсу "Физика" на англ. яз.; - Х. : НТУ "ХПИ", 2006. - 71 с. URL: http://web.kpi.kharkov.ua/tef/educational-material-in-english-ua/
4. Lyubchenko O. A. Optics. Atomic and Nuclear Physics: Конспект лекций по курсу "Физика" на англ. яз. НТУ "ХПИ", 2006. - 122 с.
5. Lyubchenko O. A. Magnetism : [problem solving guide – Kharkiv : NTU "KhPI", 2012. - 39 p. http://web.kpi.kharkov.ua/tef/wp-content/uploads/sites/114/2020/03/Magnetism_problems.pdf
6. Lyubchenko O. A. Electricity : [problem solving guide – Kharkiv : NTU "KhPI", 2015. - 42 p. http://web.kpi.kharkov.ua/tef/wp-content/uploads/sites/114/2020/03/Magnetism_problems.pdf

Additional materials
1. D.C.Giancoli. Physics for scientists and engineers with modern Physics. 4th ed., Pearson Educatioon, Inc., USA, 2009.
2. N.J.Giordano. College Physics. Reasoning and Relationships. 2 ed., V1 and 2, Brooks/Cole, Cengage Learning, USA, 2010
3. Physics. Principles and Problems. Glencoe Science Program. Interactive Students Edition., 2005 URL: http://physicspp.com
4. J. Walker. Fundamentals of physics /J.Walker, D. Halliday, R. Resnick - 10th extended ed., USA, 2014
R.A.Serway, C.Vuille, J.S.Faughn. College Physics. Brooks/Cole, Cengage Learning, USA, 2009

Assessment and grading

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

100% of the final grade consists of assessment results in the form of an exam (40%) and current assessment (60%).
Exam: written assignment (2 theory questions + problem solving) and oral presentation.
Current assessment: oral answers during practical classes, homework, individual calculation and graphic assignment (20% each).

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
	24.05.2023	Olena LYUBCHENKO
	Date, signature	Guarantor of the educational program
	08.06.2023	Uliya LITVINOVA