Syllabus
Course Program

Physics

Specialty
125 – Cybersecurity

Institute
Institute of Computer Modeling, Applied Physics and Mathematics

Educational program
Cybersecurity

Department
Physics (168)

Level of education
Bachelor's level

Course type
Mandatory

Semester
1

Language of instruction
English,

Lecturers and course developers

Olena Lyubchenko

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Candidate of science (Physics&Maths), professor, Head of Department of Physics, NTU "KhPI"

GAuthor of more than 100 scientific and educational publications. Lecturer in the "Physics" course.
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, basic methods of solving physical problems, and features of physical processes. This will ensure effective mastery of special disciplines and further ability to use physical principles in professional activities in the field of cybersecurity. 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 will master the skills of practical application of physical laws, analysis and generalization of the results of physical experiments to use them in the development of cybersecurity tools and methods.

Course objectives and goals

The objectives of the course are to provide future cybersecurity engineers with basic knowledge of physics; to develop skills in understanding the physical content of engineering problems; to develop the ability to apply fundamental knowledge of physics in the field of protection and safe use of computer equipment.

Format of classes

Lectures, practical classes, laboratory classes, independent work, calculation and graphic tasks, consultations. The final control is an exam.

Competencies

К3 2. Knowledge and understanding of the subject area and understanding of the profession.
К33. Ability to communicate professionally in the state and foreign languages both orally and in writing.

Learning outcomes

PH 1 - to apply knowledge of the state and foreign languages to ensure the effectiveness of professional communication;
PH 2 - organize own professional activity, choose the best methods and ways to solve complex specialized tasks and practical problems in professional activity, evaluate their effectiveness;
PH 3 - use the results of independent search, analysis and synthesis of information from various sources to effectively solve specialized problems of professional activity;
PH 4 - to analyze, argue, make decisions in solving complex specialized problems and practical problems in professional activities characterized by complexity and incomplete certainty of conditions, to be responsible for the decisions made;
PH 5 - to adapt to the conditions of frequent changes in the technologies of professional activity, to predict the final result;
PH 6 - critically comprehend the basic theories, principles, methods and concepts in learning and professional activities;
PH 7 - to act on the basis of the legislative and regulatory framework of Ukraine and the requirements of relevant standards, including international standards in the field of information and/or cybersecurity;
To prepare proposals for regulations to ensure information and/or cybersecurity; To prepare proposals for regulations to ensure information and/or cybersecurity;
PH 17 - to ensure the processes of protection and operation of information and telecommunication (automated) systems based on practices, skills and knowledge of structural (structural and logical) schemes, network topology, modern architectures and models of protection of electronic information resources with the reflection of interconnections and information flows, processes for internal and remote components;
PH 43 - apply national and international regulations in the field of information security and/or cybersecurity to investigate incidents;
PH 54 - to realize the values of civil (free democratic) society and the need for its sustainable development, the rule of law, human and civil rights and freedoms in Ukraine..

Student workload

The total volume of the discipline is 180 hours (6 ECTS credits): lectures - 48 hours, practical classes - 16 hours, laboratory classes (workshops) - 16 hours, independent work - 100 hours.

Course prerequisites

To successfully complete the course, you must have knowledge and practical skills in Physics, Algebra and Calculus to the extent required by the secondary school curriculum.

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

Lectures are conducted interactively with the use of multimedia technologies. Practical and laboratory classes use problem-based learning, teamwork, case studies, and student feedback.

Program of the course

Topics of the lectures

Topic 1: Elements of kinematics.
Topic 2. Dynamics of a material point and a solid body
Topic 3. Work and energy
Topic 4. Mechanical vibrations
Topic 5. Wave processes
Topic 6: Fundamentals of molecular kinetic theory of gases
Topic 7. Classical 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 the atom
Topic 20: Physics of the atomic nucleus
Topic 21. Elements of condensed matter physics
Topic 22 The concept of zone theory of solids
Topic 23. Electrical conductivity of matter
Topic 24. The concept of elementary particle physics and the modern physical picture of the world

Topics of the workshops

Topic 1: Kinematics and dynamics
Theme 2. Mechanical vibrations and waves
Theme 3. Molecular physics and thermodynamics
Theme 4. Electricity
Topic 5. Magnetism
Topic 6: Optics
Topic 7. Atomic and nuclear physics
Theme 8: Condensed matter physics

Topics of the laboratory classes

Topic 1: Mechanics. Kinematics.
Topic 2. Mechanics. Dynamics
Topic 3. Mechanical vibrations and waves
Theme 4. Molecular physics and thermodynamics
Topic 5. Electricity
Topic 6. Magnetism
Topic 7. Optics
Topic 8: Atomic and nuclear physics

Self-study

The course involves completing an individual calculation task. The results of the calculations are presented in a written report. Students are also recommended additional materials (manuals, guidelines) for independent work

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/KhPIPress/26411
2. Lyubchenko O. A. Mechanics. Oscillations and waves : Synopsis of lectures on the course "Physics" in English. language / E. A. Lyubchenko, A. Yu. Grebennyk.: NTU "KhPI", 2006. - 51 p. URL: http://web.kpi.kharkov.ua/tef/educational-material-in-english-ua/
3. Lyubchenko O. A. Electricity and magnetism : Synopsis of lectures on the course "Physics" in English. language.; - X. : NTU "KhPI", 2006. - 71 p. 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 01.07.2024 Head of the department of Physics
Olena LYUBCHENKO

28.08.2024 Guarantor of the educational program
Serhii YEVSEIEV