

SYLLABUS
in the discipline "Physics"
for students of the first (bachelor's) level of higher education
specialty G7 Automation, Computer-Integrated Technologies and Robotics
educational and professional program Robotics and Cyber-Physical Systems

1.	Name of the faculty	Faculty of Automatics and Computerized Technologies
2.	Higher education level	Bachelor
3.	Code and name of the specialty	G7 Automation, Computer-Integrated Technologies and Robotics
4.	Type and name of educational program	Robotics and Cyber-Physical Systems
5.	Code and name of the discipline	Physics
6.	Number of ECTS credits	10
7.	Structure of the discipline (distribution by types and hours of study)	1st semester 150 hours, of which: lectures 36 hours, practical 14 hours, laboratory 16 hours, consultations 12 hours, independent work 72 hours 2nd semester 150 hours, of which: lectures 36 hours, practical 14 hours, laboratory hours 14, consultations 12 hours, self-work 74 hours
8.	Schedule of study of the discipline	1st year, 1st and 2nd semester
9.	Prerequisites for studying the discipline	Knowledge of the beginning of mathematical analysis (integral and differential computation), analytical geometry and linear algebra (actions with vectors), chemistry (atomic-molecular theory, structure of atoms and molecules).
10.	Discipline abstract	The main goal of teaching the course is to create in students the foundations of broad theoretical training in the field of physics, which will allow them to navigate the flow of scientific and technical information, to apply new physical principles in the fields of technology in their future specialty. Content module 1. Classical mechanics. Topic 1. Kinematics. Topic 2. Dynamics of translational motion. Topic 3. Work and energy. Topic 4. Dynamics of rotational motion. Content module 2. Mechanical oscillations. Special theory of relativity. Molecular physics and thermodynamics. Topic 5. Mechanical oscillations. Topic 6. Special theory of relativity. Topic 7. Molecular physics. Topic 8. Thermodynamics. Content module 3. Electrostatics. Electrodynamics. Topic 9. Electric field in vacuum. Topic 10. Electric field in dielectrics. Topic 11. Conductors in an electric field. Topic 12. Direct electric current. Content module 4. Magnetism. Electromagnetic oscillations and waves. Topic 13. Magnetic field in vacuum Topic 14. Electromagnetic induction. Topic 15. The magnetic field in matter. Topic 16. Electromagnetic field.

		Topic 17. Electromagnetic oscillations and alternating current. Topic 18. Elastic waves Topic 19. Electromagnetic waves Content module 5. Optics. Elements of quantum mechanics. Topic 20. Wave optics Topic 21. Quantum optics. Topic 22. Bohr's theory of the structure of the hydrogen atom. Topic 23. Wave theory of microparticles. Topic 24. Schrödinger's equation and its application. Content module 6. Quantum theory of the structure of atoms and molecules. Solid state physics. Topic 25. Quantum theory of the structure of the hydrogen atom. Topic 26. The structure of many electron atoms. Topic 27. Structure of molecules and molecular spectra. Topic 28. Quantum statistics. Topic 29. Zone theory. Topic 30. Contact phenomena.
11.	Competences, knowledge, skills, understanding, which is acquired by the applicant of higher education in the process of learning	Competence, which provides the study of the discipline: Ability to abstract thinking, analysis Ability to apply knowledge in practical situations. Ability to model physical phenomena, perform theoretical and experimental research. Ability to learn independently, master new knowledge. Ability to apply knowledge of physics to the extent necessary to understand processes in automation systems and computer-integrated technologies. Ability to justify the choice of technical means of automation based on understanding the principles of their operation, analysis of their properties, purpose and technical characteristics, taking into account the requirements for the automation system and operating conditions; adjust technical means of automation and control systems. Ability to work with scientific equipment and measuring instruments, process and analyze the results of scientific research.
12.	Learning outcomes of higher education	Studying this discipline enables the student to: Know the basic concepts, laws and theories that explain physical phenomena, as well as physical quantities that describe physical phenomena and processes at the level necessary for solving typical tasks and automation problems. Know the limits of application of physical laws and theories of physics. Know theoretical and experimental methods of physical research. Know the physical principles of operation of modern technological equipment and apparatus. Know the purpose and possibilities of using experimental equipment for conducting physical research. Be able to analyze the relationship of physical phenomena of various nature and their impact on the operating modes of modern technology. Be able to plan and conduct the simplest physical experiments using modern equipment and process the results of these experiments. Have the ability to conduct experimental research using modern methods and process their results.

13.	Assessment system for each task for passing the test / exam	For assessment the student's work during the semester, the final rating O_{sem} is calculated as the sum of grades for different types of classes and control activities, which include practical classes, laboratory work, individual calculation task and modular testing. The distribution of points for different types of classes / control measure is given in the table: Semester 1 <table><tr><th>Types of classes / control measure</th><th>Rating O_{sem}</th></tr><tr><td>Lw №1</td><td>1 ... 2</td></tr><tr><td>Lw №2</td><td>1 ... 2</td></tr><tr><td>Lw №3</td><td>1 ... 2</td></tr><tr><td>Pl №1</td><td>2 ... 4</td></tr><tr><td>Pl №2</td><td>2 ... 4</td></tr><tr><td>Pl №3</td><td>2 ... 4</td></tr><tr><td>Test</td><td>7 ... 10</td></tr><tr><td>Checkpoint 1</td><td>16 ... 28</td></tr><tr><td>Lw №4</td><td>7 ... 11</td></tr><tr><td>Lw №5</td><td>1 ... 2</td></tr><tr><td>Lw №6</td><td>1 ... 2</td></tr><tr><td>Pl №4</td><td>2 ... 4</td></tr><tr><td>Pl №5</td><td>2 ... 4</td></tr><tr><td>Test</td><td>7 ... 10</td></tr><tr><td>Checkpoint 2</td><td>20 ... 33</td></tr><tr><td>Lw №7</td><td>1 ... 2</td></tr><tr><td>Lw №8</td><td>7 ... 11</td></tr><tr><td>Pl №6</td><td>2 ... 4</td></tr><tr><td>Pl №7</td><td>2 ... 4</td></tr><tr><td>ICT</td><td>5 ... 8</td></tr><tr><td>Test</td><td>7 ... 10</td></tr><tr><td>Checkpoint 3</td><td>24 ... 39</td></tr><tr><td>Total for the semester</td><td>60 ... 100</td></tr></table> Semester 2 <table><tr><th>Types of classes / control measure</th><th>Оцінка O_{sem}</th></tr><tr><td>Lw №1</td><td>1 ... 2</td></tr><tr><td>Lw №2</td><td>1 ... 2</td></tr><tr><td>Lw №3</td><td>1 ... 2</td></tr><tr><td>Pl №1</td><td>2 ... 4</td></tr><tr><td>Pl №2</td><td>2 ... 4</td></tr><tr><td>Pl №3</td><td>2 ... 4</td></tr><tr><td>Test</td><td>7 ... 11</td></tr><tr><td>Checkpoint 1</td><td>16 ... 29</td></tr><tr><td>Lw №4</td><td>8 ... 12</td></tr><tr><td>Lw №5</td><td>1 ... 2</td></tr><tr><td>Pl №4</td><td>2 ... 4</td></tr><tr><td>Pl №5</td><td>2 ... 4</td></tr><tr><td>Test</td><td>8 ... 11</td></tr><tr><td>Checkpoint 2</td><td>21 ... 33</td></tr><tr><td>Lw №6</td><td>1 ... 2</td></tr><tr><td>Lw №7</td><td>5 ... 9</td></tr></table>	Types of classes / control measure	Rating O_{sem}	Lw №1	1 ... 2	Lw №2	1 ... 2	Lw №3	1 ... 2	Pl №1	2 ... 4	Pl №2	2 ... 4	Pl №3	2 ... 4	Test	7 ... 10	Checkpoint 1	16 ... 28	Lw №4	7 ... 11	Lw №5	1 ... 2	Lw №6	1 ... 2	Pl №4	2 ... 4	Pl №5	2 ... 4	Test	7 ... 10	Checkpoint 2	20 ... 33	Lw №7	1 ... 2	Lw №8	7 ... 11	Pl №6	2 ... 4	Pl №7	2 ... 4	ICT	5 ... 8	Test	7 ... 10	Checkpoint 3	24 ... 39	Total for the semester	60 ... 100	Types of classes / control measure	Оцінка O_{sem}	Lw №1	1 ... 2	Lw №2	1 ... 2	Lw №3	1 ... 2	Pl №1	2 ... 4	Pl №2	2 ... 4	Pl №3	2 ... 4	Test	7 ... 11	Checkpoint 1	16 ... 29	Lw №4	8 ... 12	Lw №5	1 ... 2	Pl №4	2 ... 4	Pl №5	2 ... 4	Test	8 ... 11	Checkpoint 2	21 ... 33	Lw №6	1 ... 2	Lw №7	5 ... 9
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14.	The quality of the educational process	Compliance with the principles of academic integrity (http://lib.nure.ua/plagiat). Updating the work program of the discipline - 2025																																			
15.	Methodical support	Basic Literature: 1. Zagal'na fizyka z prykladamy i zadachamy. Chastyna 1. Mehanika. Molekuljarna fizyka ta termodynamika: navch. Posibnyk/ V.O. Storozhenko ta in.-Harkiv: TOV «Kompanija SMIT», 2006. – 320 s. 2. Zahalna fizyka z prykladamy ta zadachamy. Mekhanika: navchalnyi posibnyk dlia studentiv usikh spetsialnostei i form navchannia [Elektronnyi resurs] / A. I. Rybalka, O. M. Kovalenko, R. P. Orel ta in. ; M-vo osvity i nauky Ukrainy, Kharkiv. nats. un-t radioelektroniky. – Kharkiv : KhNURE, 2024. – 220 s. 3. Zagal'na fizyka z prykladamy i zadachamy. Chastyna 2. Elektryka ta magnetyzm: navch. posibnyk. / I.M. Kibec' ta in. - Harkiv: «Kompanija SMIT», 2009 – 424s.; 4. Zagal'n afizyka z prykladamy i zadachamy. Chastyna 3, t.1. Optyka: navch.posibnyk / I.M. Kibec' ta in. – H.:Kompanija SMIT, 2012. – 232s. 5. Zagal'na fizyka z prykladamy i zadachamy. Chastyna 3, t.2. Kvantova ta atomna fizyka. Fizyka tverdogo tila. Jaderna fizyka: navch.posibnyk / I.M.Kibec' ta in. –H.:Kompanija SMIT, 2013.–304s.. Additional literature: 1. Elementarnaja fizyka v prymerah y zadachah: ucheb. Posobyje dlja podgotovyitel'nih otdelenyj/ A.D. Tevjashev y dr. – Har'kov: HNURE, 2005. - 628s. 2. Zbirnyktestiv z kursufizyky/ O.M. Kovalenko ta in.-Harkiv: HNURE,2006.-124s.																																			

		3. Slovnyk fizychnyh terminiv: navch.-dovidkovyj posibnyk/ T.B. Tkachenko.-Harkiv: HNURE,2004.-80s. Methodical instructions to take up views: 1. Metodychni vkazivky do PZ z kursufizyky (chastyna 1)/Uporjad.:V.O.Storozhenko ta in. –Harkiv:HNURE, 2013.-152s. 2. Metodychni vkazivky do PZ z fizyky (chastyna2)/Uporjad.:V.O.Storozhenko ta in. –Harkiv:HNURE, 2013.-140s. 3. Metodychni vkazivky do laboratornyh robit z fizyky. Chastyna 1. Mehanika ta molekularnafizyka. / Uporjad.: O.V. Vyshnivec'kyj ta in. – Harkiv: HNURE, 2009. – 84s. 4. Metodychni vkazivky do laboratornyh robit z fizyky. Chastyna 2. Elektryka i magnetyzm. / Uporjad.: R. P. Orel ta in. – Harkiv: HNURE, 2019. – 120s. 5. Metodychni vkazivky do laboratornyh robit z fizyky. Chastyna 3. Optyka. Atomnafizyka ta fizykatverdogotila / Upor. Malyk S.B. ta in.- Harkiv: HNURE, 2011. 6. Metodychni vkazivky do kompiuternykh laboratornykh robit z dystsypliny «FIZYKA» dlia studentiv usikh spetsialnostei i form navchannia / Uporiad.: R. P. Orel, O. M. Kovalenko, A. I. Rybalka ta inshi – Kharkiv: KhNURE, 2021. – 132 s. Information support: https://physic.nure.ua https://catalogue.nure.ua/knmz/?subdivision=24&level=0&query=undefined
16.	Syllabus developer	Associated Professor of Physics Department Orel Roman Petrovich, roman.orel@nure.ua