SYLLABUS
in the discipline "Physics"
for students of the first (bachelor's) level of higher education
specialty F4 System Analysis and Data Science
educational and professional program
System Analysis
Kharkiv National University of Radio Electronics

1.	Name of the faculty	Information and Analytical Technologies and Management
2.	Level of higher education	bachelor
3.	Code and name of the specialty	F4 System Analysis and Data Science
4.	Type and name of educational program	System Analysis
5.	Code and name of the discipline	Physics
6.	Number of ECTS credits	6
7.	Discipline structure (distribution by types and hours of study)	**1st semester** 90 hours, of which: lectures 20 hours, practical 10 hours, laboratory 12 hours, consultations 6 hours, independent work 42 hours **2nd semester** 90 hours, of which: lectures 20 hours, practical 8 hours, laboratory 8 hours, consultations 8 hours, independent work 46 hours
8.	The schedule of studying the discipline	1 course; 1,2 semesters
9.	Prerequisites for studying the discipline	List of disciplines that should be studied earlier: beginning of mathematical analysis (integral and differential calculus), analytical geometry and linear algebra (operations 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, apply new physical principles in the fields of technology in their future specialty. Module 1 (1st semester) Content module 1. Mechanics. Topic 1. Kinematics. Topic 2. Dynamics. Topic 3. Work and energy. Content module 2. Electricity. Topic 4. Electric field in vacuum. Topic 5. Gauss's theorem. Topic 6. Electric field in dielectrics. Topic 7. Conductors in an electric field. Topic 8. Direct electric current. Topic 9. Ohm's law, Kirchhoff's rules, Joule-Lenz law. Module 2 (2nd semester) Content module 3. Magnetism. Topic 10. Magnetic field in vacuum. Topic 11. Electromagnetic induction.

		Topic 12. Magnetic field in matter. Topic 13. Electromagnetic field. Topic 14. Electromagnetic oscillations and alternating current. Content module 4. Waves and optics. Elements of quantum mechanics. Topic 15. Electromagnetic waves. Topic 16. Wave optics. Topic 17. Quantum optics. Topic 18. Laws of thermal radiation
11.	Competences, knowledge, skills, understanding, which is acquired by the applicant in higher education in the learning process	Competencies provided by the study of the discipline: 1. The ability to use and adapt mathematical theories, methods and techniques to prove mathematical statements and theorems. 2. The ability to abstract thinking, analysis and synthesis. 3. The ability to model various phenomena, perform theoretical and experimental research. 4. The ability to independently learn, master new knowledge 5. The ability to process and analyze the results of scientific research 6. Knowledge and understanding of the subject area and understanding of professional activity. 7. The ability to apply knowledge in practical situations. 8. The ability to make informed decisions. 9. The ability to communicate with representatives of other professional groups of different levels (with experts from other fields of knowledge/types of economic activity). 10. Carrying out safe activities. 11. The ability to work autonomously. 12. The ability to work in a team.
12.	Learning outcomes of higher education	As a result of studying the discipline, applicants must: *know:* basic concepts, laws and theories that explain physical phenomena, as well as physical quantities with which physical phenomena and processes are described; the essence of physical phenomena, their mechanisms, cause-and-effect relationships in physical processes; the limits of application of physical laws and theories of physics; theoretical and experimental methods of physical research; *be able to:* apply knowledge of the basic forms and laws of abstract-logical thinking, the foundations of the methodology of scientific knowledge, forms and methods of extracting, analyzing, processing and synthesizing information in the subject area of computer science; analyze the relationship of physical phenomena of various nature; plan and conduct the simplest physical experiments using modern equipment and process the results of these experiments; highlight specific physical content in applied problems of the future specialty; *have:* the ability to abstract thinking, analysis and synthesis; the ability to apply knowledge in practical situations; the ability to identify, pose and solve problems in a professional direction; the ability to mathematically formulate and investigate continuous and discrete mathematical models, justify the choice of methods and approaches for solving theoretical and applied problems in the field

<table>
<tr><td></td><td></td><td>of computer science, analysis and interpretation; the ability to learn and master modern knowledge</td></tr>
<tr><td>13.</td><td>Assessment system according to each task for passing the exam</td><td>Assessment of students' knowledge in the discipline is carried out on the basis of the results of current control, module control and the exam, which are reflected in the final module control.
The task of current control is to check the understanding and assimilation of certain material, which is carried out during lectures, practical and laboratory classes in the form of students' discussion of current issues in the discipline, the performance of certain theoretical (express control of theoretical knowledge in practical and laboratory classes) and practical (solving problems, performing laboratory work) tasks (classroom work), as well as assessing the results of their independent work (performing homework in practical classes) and performing individual calculation tasks (out-of-classroom work).
The task of module control is to check the assimilation of educational material contained in this content module. Module control is implemented in the appropriate forms of the educational process. Tasks submitted for module control are evaluated in points. Module control is carried out in writing or with the help of computer testing or control work. Module control includes, in particular, computer testing and defense of the cycle of laboratory work.
Final module control is an assessment of students' knowledge for each of the credit modules, which is carried out on the basis of determining the sum of points (with appropriate weight) based on the results of current control for classroom and extracurricular work, module control and the exam in the discipline. Final control is considered passed successfully if the student received at least 60 points out of 100 possible. The points obtained are converted according to the national scale and ECTS scale
To assess the student's work during the semester, the final rating score is calculated as the sum of the marks for different types of classes and control measures. The distribution of points for different types of classes / control measures is given in the table.

<table>
<tr><td>Type of lesson / test</td><td>Rating O_{sem}</td></tr>
<tr><td>laboratory work</td><td>0,25 O_{sem}</td></tr>
<tr><td>practical classes</td><td>0,25 O_{sem}</td></tr>
<tr><td>Checkpoint 1</td><td></td></tr>
<tr><td>laboratory work</td><td>15 … 25</td></tr>
<tr><td>practical classes</td><td>15 … 25</td></tr>
<tr><td></td><td>30 … 50</td></tr>
<tr><td>Checkpoint 2</td><td></td></tr>
<tr><td>laboratory work</td><td>15 ... 25</td></tr>
<tr><td>practical classes</td><td>15 ... 25</td></tr>
<tr><td></td><td>30 ... 50</td></tr>
<tr><td>Final for the semester</td><td>60 ... 100</td></tr>
</table>
</td></tr>
</table>

<table>
<tr><td></td><td></td><td>The combined exam is used as a form of final control for the discipline "Physics".With this type of control, the final grade is calculated by the formula: $P_n = 0{,}6 \cdot O_{sem} + 0{,}4 \cdot O_{ex}$, where O_{sem} – grade for the semester in a 100-point system, O_{ex} – grade for the exam in a 100-point system.
Required knowledge to obtain a positive assessment.
1. Basic concepts, laws and models of mechanics, electricity, magnetism, oscillations, waves, quantum physics, statistical physics, thermodynamics, atomic nucleus physics.
2. Limits of application of physical concepts and laws.
3. Principles of construction of physical models and their use.
Required skills to obtain a positive assessment.
1. Calculation of parameters of physical objects, using basic concepts, laws and models of mechanics, electricity, magnetism, oscillations, waves, quantum physics and thermodynamics to solve practical problems.
2. Conducting the simplest physical experimental studies.
3. Processing the results of experimental studies, using methods for evaluating the results of experiments and calculating their errors.
The final grade is translated into national and ECTS according to the scale:
<table>
<tr><td rowspan="2">Grade from the discipline</td><td colspan="2">Score on a national scale</td><td rowspan="2">ECTS scale score</td></tr>
<tr><td>exam</td><td>credit</td></tr>
<tr><td>96-100</td><td>5 (perfectly)</td><td rowspan="5">passed</td><td>A</td></tr>
<tr><td>90-95</td><td>5 (perfectly)</td><td>B</td></tr>
<tr><td>75-89</td><td>4 (good)</td><td>C</td></tr>
<tr><td>66-74</td><td>3 (satisfactorily)</td><td>D</td></tr>
<tr><td>60-65</td><td>3 (satisfactorily)</td><td>E</td></tr>
<tr><td>35-59</td><td rowspan="2">2 (unsatisfactorily)</td><td rowspan="2">not passed</td><td>FX</td></tr>
<tr><td>1-34</td><td>F</td></tr>
</table>
</td></tr>
<tr><td>14.</td><td>The quality of the educational process</td><td>Adherence to the principles of academic integrity (http://lib.nure.ua/plagiat). Timely updating of the content of the discipline depending on the modern needs of the specialty</td></tr>
<tr><td>15.</td><td>Methodical support</td><td>Basic literature
1. General Physics with Examples and Problems. Mechanics: A Textbook for Students of All Specialties and Forms of Study [Electronic Resource] / Compiled by: A.I. Rybalka et al. – Kharkiv: KhNURE, 2024. – 220 p.
2. General physics with examples and problems. Part 2. Electricity and magnetism: textbook. manual./ IM Kibets and others. - Kharkiv: SMITH Company, 2009 - 424p .;
3. General physics with examples and problems. Part 3, item 1. Optics: textbook / IM Kibets and others. - H.: SMITH Company, 2012. - 232p.
Supporting literature
1. Collection of tests from the course of physics / O.M. Kovalenko and others.- Kharkiv: KNURE, 2006. –124s.</td></tr>
</table>

		2. Dictionary of physical terms: textbook / TB Tkachenko.- Kharkiv: KNURE, 2004.-80p. **Methodical instructions for different types of classes** 1. Methodical instructions for software in the course of physics (part 1) / Edited by: VO Storozhenko and others. –Kharkiv: KhNURE, 2013.-152p. 2. Methodical instructions for software in physics (part 2) / Edited by: VO Storozhenko and others. –Kharkiv: KhNURE, 2013.-140p. 3. Methodical instructions for laboratory work in physics. Part 2. Electricity and magnetism. / Edited by: RP Orel and others. - Kharkiv: KNURE, 2019. - 120p. 4. Methodical instructions for laboratory work in physics. Part 3. Optics. Atomic physics and solid state physics / Emphasis. Malik SB etc. - Kharkiv: KNURE, 2011. 5. Methodical instructions for computer laboratory work in physics./ Edited by: R. P. Orel, O. M. Kovalenko, A. I. Rybalka and others - Kharkiv: Khnure, 2021. - 132 **Information support:** 1. https://physic.nure.ua. 2. https://catalogue.nure.ua/knmz/?subdivision=24&level=0&query=undefined
16.	Syllabus developer	Professor of the Department of Physics Volodymyr Oleksandrovych Storozhenko volodymyr.storozhenko@nure.ua