SYLLABUS
in the discipline "Physics"
for students of the first (bachelor's) level of higher education
specialty 153 Micro- and nanosystem technology
educational and professional program Micro- and nanoelectronics

1.	Name of the faculty	Faculty of Electronic and Biomedical Engineering
2.	Level of higher education	bachelor
3.	Code and name of the specialty	153 Micro- and nanosystem technology
4.	Type and name of educational program	Micro- and nanoelectronics
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 hours 12, consultations 6 hours, independent work 42 hours 2nd semester 90 hours, of which: lectures 20 hours, practical 8 hours, laboratory 8 hours, consultations 6 hours, independent work 48 hours
8.	The schedule of studying the discipline	1 course, 1,2 semesters
9.	Prerequisites for studying the discipline	Knowledge of the main sections of higher mathematics, including mathematical analysis (differential and integral calculation), analytical geometry and linear algebra (actions with vectors), chemistry (atomic-molecular theory, structure of atoms and molecules).
10.	Discipline abstract	**Content module 1. Physical foundations of mechanics.** Theme1. Kinematics. Theme 2. Dynamics of translational motion. Theme 3. Work and energy. Theme 4. Dynamics of rotational motion. Theme 5. Mechanical oscillations. **Content module 2. Electrostatics.** Theme 6Electric field in vacuum. Theme 7. Electric field in dielectrics. Theme 8. Conductors in an electric field. Theme 9. Direct current. **Content module 3. Magnetic field.** Theme 10. Magnetic field in vacuum. Theme 11. Magnetic field in matter. Theme 12. The phenomenon of electromagnetic induction. Theme 13. Electromagnetic field. Theme 14. Electromagnetic oscillations and alternating current **Content module4. Waves. Optics. Elements of quantum mechanics and solid state physics** Theme 15. Waves. Theme 16. Wave optics. Theme 17. Quantum optics. Theme 18. Quantum mechanics. Theme 19. Quantum theory of the structure of atoms and molecules. Theme 20. Band theory of electrical conductivity of solids.
11.	Competences, knowledge, skills, understanding, which is acquired by the applicant in	**Competences that provide the study of the discipline:** Ability to abstract thinking, analysis, the ability to navigate in the flow of scientific and technical information.

<table>
<tr><td></td><td>higher education in the learning process</td><td>Ability to apply knowledge in practical situations
Ability to model physical phenomena, perform theoretical and experimental studies.
Ability to learn independently, to master new knowledge
Ability to work with scientific equipment and measuring instruments, process and analyze the results of scientific research, solve applied engineering problems in their specialty.</td></tr>
<tr><td>12.</td><td>Learning outcomes of higher education</td><td>The study of this discipline gives the student the opportunity to:
know: basics of physical laws and fundamental physical concepts, laws and theories of classical and modern physics and the limits of their application, the essence of physical phenomena, areas of their practical use, physical principles of modern technological equipment and apparatus in the field of professional activity; purpose and possibilities of application of the experimental equipment for carrying out physical research.
be able to: analyze the relationship of physical phenomena of different nature; apply knowledge of physical laws to solve practical problems that arise during the development and operation of radio systems and television and radio broadcasting systems, etc .; to analyze the influence of physical phenomena on the modes of operation of modern technology; plan and conduct the simplest physical experiments using modern equipment and process the results of these experiments; highlight specific physical content in the applied problems of the future specialty
have: modern methods of experimental physical research and processing of their results, basic methods of working with physical equipment and methods for estimating the errors of experiments.</td></tr>
<tr><td>13.</td><td>Assessment system according to each task for passing the exam</td><td>To evaluate 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 and modular testing.
The distribution of points for different types of classes / tests is given in the table:
Semester 1
<table>
<tr><th>Control measure</th><th>Rating O_{sem}</th></tr>
<tr><td>Lw №1</td><td>2 . . . 4</td></tr>
<tr><td>Lw №2</td><td>2 . . . 4</td></tr>
<tr><td>Lw №3 Control lesson</td><td>5 . . . 10</td></tr>
<tr><td>Pc №1</td><td>4 . . . 7</td></tr>
<tr><td>Pc №2</td><td>4 . . . 7</td></tr>
<tr><td>Pc №3</td><td>4 . . . 7</td></tr>
<tr><td>Test</td><td>11 . . . 14</td></tr>
<tr><td>Checkpoint 1</td><td>32 . . . 53</td></tr>
<tr><td>Lw №4</td><td>2 . . . 4</td></tr>
<tr><td>Lw №5</td><td>2 . . . 4</td></tr>
<tr><td>Lw №6 Control lesson</td><td>5 . . . 10</td></tr>
<tr><td>Pc №4</td><td>4 . . . 7</td></tr>
<tr><td>Pc №5</td><td>4 . . . 7</td></tr>
<tr><td>Test</td><td>11 . . . 15</td></tr>
<tr><td>Checkpoint 2</td><td>28 . . . 47</td></tr>
<tr><td>Total for the semester</td><td>60 . . . 100</td></tr>
</table>
Semester 2</td></tr>
</table>

		<table><tr><td>Control measure</td><td>Rating O_{sem}</td></tr><tr><td>Lw №1</td><td>3 . . . 5</td></tr><tr><td>Lw №2</td><td>3 . . . 5</td></tr><tr><td>Pc №1</td><td>4 . . . 7</td></tr><tr><td>Pc №2</td><td>4 . . . 7</td></tr><tr><td>Test</td><td>10 . . . 19</td></tr><tr><td>Checkpoint 1</td><td>24 . . . 43</td></tr><tr><td>Lw №3</td><td>3 . . . 5</td></tr><tr><td>Lw №4 Control lesson</td><td>13 . . . 18</td></tr><tr><td>Pc №3</td><td>4 . . . 7</td></tr><tr><td>Pc №4</td><td>4 . . . 7</td></tr><tr><td>Test</td><td>12 . . . 20</td></tr><tr><td>Checkpoint 2</td><td>36 . . . 57</td></tr><tr><td>Total for the semester</td><td>60 . . . 100</td></tr></table> As a form of final control for the discipline "Physics" credit is used in semester 1. The final grade is determined as the number of points received by the applicant for education for completing control activities during the semester. The combined exam is used as a form of final control for the discipline "Physics" in semester 2. 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. 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>
14.	The quality of the educational process	The content of the discipline can be updated depending on the modern needs of the specialty.
15.	Methodical support	**Basic literature** 1. General physics with examples and problems. Part 1. Mechanics. Molecular physics and thermodynamics: textbook. manual./ VO Storozhenko and others. - Kharkiv: SMITH Company, 2006 - 320p .; 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. manual / IM Kibets and others. - H.: SMITH Company, 2012. - 232p. 4. General physics with examples and problems. Part 3, item 2. Quantum and atomic physics. Solid state physics. Nuclear physics: textbook / IM Kibets and others. - H.: SMITH Company, 2013. - 304p.

		5. A short course in physics. Textbook / IN Kibets et al ..- H .: SMITH Company. 2015.-328p. **Supporting literature** 1. Collection of tests in the course of physics / O.M. Kovalenko and others.- Kharkiv: KNURE, 2006.-124p. 2. Dictionary of physical terms: textbook / T.B. 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 1. Mechanics and molecular physics. / Edited by: OV Vyshnivetsky and others. - Kharkiv: KNURE, 2009. - 84p. 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./ O.M. Kovalenko and others.- Kharkiv: KNURE, 2006-124p. **Information support:** http://physic.nure.ua http://catalogue.nure.ua/knmz/?subdivision=24&level=0&query=undefined
16.	Syllabus developer	Associate Professor of Physics Kalinin Vitaly Veniaminovich, vitaly.kalinin@nure.ua