**SYLLABUS**

**regarding the qualification cycle FROM 2023 TO 2024**

1. Basic Course/Module Information

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| --- | --- |
| Course/Module title | Physics |
| Course/Module code \* |  |
| Faculty (name of the unit offering the field of study) | College of Natural Sciences |
| Name of the unit running the course | Institute of Physics |
| Field of study | Diagnostic systems in medicine |
| Qualification level | First-cycle studies |
| Profile |  |
| Study mode | Full-time |
| Year and semester of studies | Year 1, winter or summer semester |
| Course type |  |
| Language of instruction | English |
| Coordinator | dr hab. Marcin Wesołowski, prof. UR |
| Course instructor |  |

\* - as agreed at the faculty

1.1.Learning format – number of hours and ECTS credits

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Semester  (n0.) | Lectures | Classes | Colloquia | Lab classes | Seminars | Practical classes | Internships | others | **ECTS credits** |
| 2 |  | 30 |  |  |  |  |  |  | **6** |

1.2. Course delivery methods

☒ conducted in a traditional way

☐ involving distance education methods and techniques

1.3. Course/Module assessment (exam, pass with a grade, pass without a grade)

Classes – exam

2. Prerequisites

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| Knowledge of kinematics, dynamics, hydrostatics, hydrodynamics, thermodynamics, electrostatics and electric circuits at the level of the first year of study. |

3. Objectives, Learning Outcomes, Course Content, and Instructional Methods

3.1. Course/Module objectives

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| --- | --- |
| O1 | to familiarize students with the basic concepts used in physics |
| O2 | teaching students to formulate physical issues and problems in the language of mathematics |
| O3 | acquiring by students the ability to use the laws of physics in practice in solving simple physical problems |

3.2. Course/Module Learning Outcomes (to be completed by the coordinator)

|  |  |  |
| --- | --- | --- |
| Learning Outcome | The description of the learning outcome  defined for the course/module | Relation to the degree programme outcomes |
| LO\_01 | the student knows differential and integral calculus, algebra and applied mathematics issues enabling the description, understanding and modelling of physical problems with a significant level of complexity | K\_W01 |
| LO\_02 | the student knows the basic theorems and laws of the main fields of physics, in particular, mechanics, electromagnetism, optics, thermodynamics, electricity and quantum mechanics | K\_W02 |
| LO\_03 | the student is able to analyse problems in the field of physics and find solutions based on known theorems and methods | K\_U01 |
| LO\_04 | the student is able to present the elaboration of a specific problem in the field of physics and its applications in medicine and technology | K\_U05 |
| LO\_05 | the student is able to carry out simple physics experiments and interpret the obtained results | K\_U06 |
| LO\_06 | the student can work in a group and organize individual and teamwork | K\_U14 |
| LO\_07 | the student can design his/her educational path related to issues in the field of physics | K\_U15 |
| LO\_08 | the student is ready to take action to popularize physics and its application in medicine | K\_K04 |
| LO\_09 | the student is ready to perform professional roles in a responsible manner that require competences appropriate for a graduate of Diagnostic systems in medicine studies | K\_K06 |

**3.3. Course content (to be completed by the coordinator)**

1. Lectures

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| Content outline |
| Magnetic field in a vacuum. The influence of the magnetic field on a current-carrying conductor; magnetic induction; the action of a force on a charge moving in a magnetic field; cyclotron |
| Biot-Savart law. The magnetic field of a straight-line conductor with current; the interaction of parallel conductors with current. Ampère's law - selected applications |
| Electromagnetic induction. Faraday's law of electromagnetic induction; self and mutual induction; magnetic field energy; alternating current; Maxwell's equations |
| Harmonic motion: mechanical and electrical vibrations; harmonic oscillator; damped and forced vibrations; resonance phenomenon; alternating current in a series RLC circuit; the general form of Ohm's law for alternating currents; electrical resonance |
| Wave motion: quantities describing wave motion; longitudinal and transverse waves; plane wave equation; interference phenomenon; standing wave; Doppler phenomenon |
| Optics - introduction: optics is the science of light (the concept of light, light ray, light beam), models of light (geometric, wave and corpuscular). Fundamentals of photometry (the concept of a solid angle, basic photometric quantities: luminous flux, light source intensity and illumination). Methods of measuring the speed of light. Light sources (classification of light sources: incandescent lamps, arc lamps, discharge lamps, e.g. mercury and sodium lamps, and fluorescent lamps, the principle of laser operation). |
| Fundamentals of optoelectronics: optical fibres; lasers; solar batteries; light detectors; selected applications of devices in medicine and telecommunications |
| Band theory of solids, semiconductors, intrinsic and impurity conductivity, p-n junction and selected applications on the example of a diode and a transistor. |

1. Classes, tutorials/seminars, colloquia, laboratories, practical classes

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| Content outline |
| The magnetic field in a vacuum. The influence of the magnetic field on a current-carrying conductor; magnetic induction |
| Biot-Savart law. The magnetic field of a straight-line current-carrying conductor. Ampere's law |
| Electromagnetic induction. Faraday's law of electromagnetic induction |
| Optics. Basic photometric quantities: luminous flux, light source intensity and illumination. Geometric, wave and corpuscular nature of light. Light polarization. Photometry |
| Semiconductors and intrinsic and impurity conductivity; p-n junction |
| **Exemplary laboratory exercises:** |
| Study of damped vibrations of a spring pendulum. |
| Determination of the viscosity coefficient of liquids by the Stokes method. |
| Measurement of the heat of melting ice. |
| Air humidity measurement. |
| Determination of the Cp/Cv ratio using the Clement-Desormes method |
| Determination of the capacitor charge from the discharge curve. |
| Extending the measuring range of electric meters |
| Transformer test. |
| Measurement of the wavelength of light using a diffraction grating.  Newton's rings. |
| Investigation of the rotation of the plane of polarization by an aqueous solution of sugar. |
| Experimental checking of Malus' law. |
| Measurement of the refractive index using an Abbe refractometer. |
| Study of the dispersion of the prism glass using an optical goniometer. |
| Characteristics of a semiconductor diode. |

3.4. Methods of Instruction

e.g.

*Lecture: a problem-solving lecture/a lecture supported by a multimedia presentation/ distance learning*

*Classes: text analysis and discussion/project work (research project, implementation project, practical project)/ group work (problem solving, case study, discussion)/didactic games/ distance learning*

*Laboratory classes: designing and conducting experiments*

4. Assessment techniques and criteria

4.1 Methods of evaluating learning outcomes

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| --- | --- | --- |
| Learning outcome | Methods of assessment of learning outcomes (e.g. test, oral exam, written exam, project, report, observation during classes) | Learning format (lectures, classes,…) |
| LO-01 | test | classes |
| LO-o2 | test | classes |
| LO-03 | observation during classes, test | classes |
| LO-o4 | observation during classes, test | classes |
| LO-05 | observation during classes, | classes |
| LO-o6 | observation during classes, | classes |
| LO-07 | observation during classes, | classes |
| LO-o8 | observation during classes, | classes |
| LO-09 | observation during classes | classes |

4.2 Course assessment criteria

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| Method of passing the classes - passing with a grade;  Completion of the subject will confirm the degree to which the student has achieved the assumed learning outcomes. Verification of the achieved learning outcomes is controlled on an ongoing basis during the course. The grade obtained from completing the course will allow you to assess the degree of achieved effects. The final grade is the arithmetic mean of the grades from the two tests. All tests must be passed. Student activity in class is also taken into account.  Requirements corresponding to individual assessments:  Very good rating  The student has mastered the full range of knowledge and skills specified in the curriculum. Efficiently uses the acquired information, knows how to use various sources of knowledge, solves calculation and problem tasks independently. Able to apply acquired knowledge in new situations.  Good rating  The student has mastered a large range of more complex knowledge and skills. However, he did not fully master the knowledge specified in the curriculum. Applies messages correctly to solve common tasks or problems.  Satisfactory  The student has mastered the most important information from the point of view of the subject, simple, easy to learn. Solves typical tasks with the help of the teacher, knows the basic theorems and formulas. |

5. Total student workload needed to achieve the intended learning outcomes

– number of hours and ECTS credits

|  |  |
| --- | --- |
| Activity | Number of hours |
| Scheduled course contact hours | 30 |
| Other contact hours involving the teacher (consultation hours, examinations) | 4 |
| Non-contact hours - student's own work (preparation for classes or examinations, projects, etc.) | 81 |
| Total number of hours | 115 |
| Total number of ECTS credits | 6 |

\* One ECTS point corresponds to 25-30 hours of total student workload

6. Internships related to the course/module

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| --- | --- |
| Number of hours | *-* |
| Internship regulations and procedures | *-* |

7. Instructional materials

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| Compulsory literature:  Resnick Robert, Halliday David, Physics, part I and II, 2002, New York : John Wiley  Paul Peter Urone, Roger Hinrichs, This Physics, 2020. (<https://openstax.org/details/books/physics?Book%20details>)  Gregg Wolfe, et al. College Physics, 2022, <https://openstax.org/details/books/college-physics-ap-courses-2e> |
| Complementary literature:  Additional literature will be available from the academic teacher. |

Approved by the Head of the Department or an authorised person