SYLLABUS

Course description

<table>
<tr><td colspan="2">Course code</td><td rowspan="2">Course</td><td colspan="4">FIZYKA</td></tr>
<tr><td colspan="2">MB/O/I/ST/A.2</td><td colspan="4">PHYSICS</td></tr>
<tr><td colspan="3">Language of instruction</td><td colspan="4">English</td></tr>
<tr><td colspan="3">Academic year</td><td colspan="4">2023/2024</td></tr>
<tr><td colspan="3">field of study:</td><td colspan="4">Mechanical engineering</td></tr>
<tr><td colspan="3">field of specialisation:</td><td colspan="4">All</td></tr>
<tr><td colspan="3">Educational level</td><td colspan="4">first-cycle studies</td></tr>
<tr><td colspan="3">Education profile</td><td colspan="4">General academic</td></tr>
<tr><td colspan="3">Mode of study</td><td colspan="4">Full-time studies</td></tr>
<tr><td colspan="3">Semester(s)</td><td colspan="4">1, 2</td></tr>
<tr><td colspan="3">Affiliation with a group of classes</td><td colspan="4">Basic classes</td></tr>
<tr><td colspan="3">Course status</td><td colspan="4">Obligatory</td></tr>
<tr><td colspan="3" rowspan="4">Types of classes, instruction hours, ECTS credits</td><td>Types of classes</td><td>Number of instruction hours</td><td colspan="2">Number of ECTS credits</td></tr>
<tr><td>Lecture</td><td>30 [h]</td><td colspan="2" rowspan="3">8 ECTS</td></tr>
<tr><td>Computational classes</td><td>30 [h]</td></tr>
<tr><td>Laboratory classes</td><td>30 [h]</td></tr>
<tr><td rowspan="3">Linkage of the course</td><td>with the education profile</td><td colspan="3">Related to the conducted scientific activity in the discipline to which the field of study is assigned</td><td>8 ECTS</td></tr>
<tr><td>with qualifications</td><td colspan="3">It is used to acquire engineering competences by the student</td><td>8 ECTS</td></tr>
<tr><td>with science discipline</td><td colspan="3">Mechanical engineering</td><td>8 ECTS</td></tr>
<tr><td colspan="2">Form of teaching</td><td colspan="4">Traditional – classes organized at the University /classes conducted using online learning methods and techniques</td></tr>
<tr><td colspan="2">Prerequisites</td><td colspan="4">No formal requirements (recommended knowledge in physics and mathematics at the level of the extended secondary school exam)</td></tr>
<tr><td colspan="2">Department</td><td colspan="4">Faculty of Mechanical Engineering</td></tr>
<tr><td colspan="2">Coordinator</td><td colspan="4">Assoc. prof. Tadeusz Szumiata, PhD.</td></tr>
<tr><td colspan="2">The website of the basic organizational unit</td><td colspan="4">https://wm.uniwersytetradom.pl/</td></tr>
<tr><td colspan="2">E-mail address, phone number of the coordinator</td><td colspan="4">t.szumiata@uthrad.pl, (48) 361-78-46</td></tr>
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LEARNING OUTCOMES, CURRICULUM CONTENT, TEACHING CLASSES, VERIFICATION OF LEARNING OUTCOMES

Learning Objective:	To provide students with knowledge of the basic physical laws governing the phenomena of nature and forming the basis for the functioning of technical devices. To form in students the ability to independently solve tasks involving the application of the laws of physics and mathematical methods to describe selected phenomena and mechanical, thermodynamic, optical and electrical systems. To develop in students the ability to work in the laboratory, to perform measurements of various physical quantities, to develop and present measurement data, to perform calculations of measurement uncertainty and to verify theoretical models on the basis of experiment.
Curriculum Content:	The entire content of the classes - lecture, auditory (calculus) and laboratory exercises - is related to the scientific research. Laboratory exercises and part of the examples solved in the lecture and auditory exercises are related to the formation of practical skills. Curricular content is in accordance with the learning outcomes and takes into account the current knowledge and its application within the disciplines related to the conducted course. LECTURE [BN, W1, W2, U1]: Kinematics: classification of motions, use of vectors to describe multidimensional motions. Dynamics: types of forces and interactions in nature; laws of dynamics; work and energy; dynamics of a system of point masses; laws of conservation of energy and momentum. Gravity. Rotational motion of a rigid body. Microscopic structure of matter. Vibrational and wave motion. Elements of thermodynamics and kinetic theory of gases. Electrostatics: charge and electric field; capacitors; electrical properties of matter. Electric current: Ohm's law; direct current circuits and Kirchhoff's laws; power sources. Magnetic field. Electromagnetic induction. Electrical and magnetic properties of matter. Alternating current. Maxwell's laws and electromagnetic waves. Fundamentals of geometrical and wave optics. Elements of modern physics: waves and particles, elements of quantum physics and solid state and nuclear physics, elements of relativistic physics. Total: 30 [h]. COMPUTATIONAL CLASSES [BN, W1, W2, U1]: Rectilinear motion (uniform, uniformly accelerated and decelerated). Curvilinear motion. Fundamentals of the dynamics of a material point and a system of point masses, the composition of forces, friction, inertia forces. Momentum, work, energy, power, laws of conservation, collisions. Kinematics and dynamics of rotational motion of a rigid body, moment of inertia. Simple harmonic motion and wave motion. Elements of thermodynamics: perfect gas, heat balance, first law of thermodynamics, energy transformations. Electrostatic field. Electrical capacitance. Connecting capacitors. Energy of a capacitor. DC circuits - Kirchhoff's laws. Electrical resistance. Ohm's law. Power of current. Magnetic field of conductors with current. Interaction of conductors with magnetic field. Electromagnetic induction. Alternating current circuits. Calculus checks. Total: 30 [h]. LABORATORY CLASSES [BN, W2, U1, U2, U3, K1]: Introductory classes: division of students into teams, assignment of exercises; discussion of measurement uncertainty calculus and principles of measurement data processing and presentation (including - using a computer), as well as health and safety rules.

	Subsequent activities: students perform laboratory exercises in teams (5 exercises selected from the following list): * Study of the spring pendulum. * Study of a physical pendulum. * Archimedes' law and determination of density of bodies. * Determination of the coefficient of dynamic viscosity of liquids. * Thermoelectric phenomenon and the phenomenon of melting. * Current-voltage characteristics of two-wire elemnts. * Determination of the thermal coefficient of resistance for a conductor. * Determination of capacitance of a capacitor and study of charging and discharging processes of a capacitor. * Determination of the value and distribution of magnetic induction in the gap between the poles of an electromagnet using a hallotron. * Testing a serial RLC circuit using a two-channel oscilloscope. * Determination of the speed of sound in air using the oscilloscope method. * Determination of the focal distance of thin lenses. * Determination of the diffraction grating constant and study of the optical spectrum of an electric discharge lamp. Total: 30 [h].
Didactic (educational) methods:	- transferring-type methods (informative lecture, lecture, reading), - programmed methods (using a computer), - practical methods (demonstration, laboratory exercises, accounting, production, project method, simulation)
Course assessment type, the criteria for assessing the achieved learning outcomes, and the method of calculating the final grade:	In order to pass a course, a student must achieve all the required learning outcomes specified for the course. Obtaining positive grades from all forms of classes included in a given subject is equivalent to passing the subject and earning by the student the number of ECTS points assigned to the subject. The method of calculating the final grade for a subject is specified in the study regulations. The method of obtaining a grade for individual forms of classes is as follows: Passing of computational (auditorial) classes: obtaining the minimum number of points (50%) from the tests, taking into account additional points for activity in class. Passing the lecture/examination: obtaining a positive grade (equivalent to obtaining at least 50% of the maximum number of points) from the final written credit colloquium/examination in the form of open questions, choice tests or calculation instructions. The lecturer may award additional points for the evaluation of calculus exercises, activity, and for any project-simulation tasks. A rule may also be introduced that the condition for taking the final written credit colloquium/examination is to obtain a positive grade (at least “satisfactory grade” 3.0) of the computational exercises. The lecturer may introduce two forms of lecture credit: basic (for grades 3.0 and 3.5) and extended (for grades 4.0, 4.5 and 5.0). Possible simulation-design tasks (related to physics or technology) should use computational tools in accordance with the Industry 4.0 standard (Matlab, SageMath /Python). Passing laboratory classes: obtaining at least 15 points from the performed exercises (grade calculated according to the regulations of the Didactic Physics Laboratory).

Learning outcomes for the course in relation to the field of study learning outcomes and the type of classes				Methods of verifying learning outcomes	
Learning outcome number	Description of the learning outcomes for the course (PEU) A student who has passed the course (**W**) knows and understands / (**U**) can / (**K**) is ready to:	Field of study learning outcome (KEU)	Types of classes	Form of verification (credits)	Methods of testing and assessment
W1	A student who has passed the subject of PHYSICS knows and understands the issues of classical physics and the basics of relativistic and quantum physics, in particular: - general principles of physics, physical quantities, fundamental interactions, - material point and rigid body mechanics, oscillatory and wave motion, thermodynamics, statistical physics, electricity, magnetism and optics, introductory information on relativistic physics, solid state and nuclear physics, and quantum physics.	K_WG02 K_WG05 K_WG08	Lecture / Exercises	Credit / Examination	Internal, topical assessment
W2	A student who has passed the subject of PHYSICS knows and understands in detail selected physical phenomena and is able to apply his knowledge in the design, manufacture and operation of selected technical equipment. He also has theoretical knowledge of the principles of conducting and processing of measurement results, types of measure-ment uncertainty and ways of determining them.	K_WG02 K_WG05 K_WG08 K_WG12	Lecture / Exercises / Laboratory	Credit / Examination	Internal, topical assessment
U1	A student who has passed the subject of PHYSICS is able to obtain information from the literature and independently solve simple calculation problems in physics - with particular emphasis on issues related to the analysis of the operation, design and operation of selected technical equipment. He can use the learned principles and methods of physics and appropriate mathematical tools to solve technical problems.	K_UW01 K_UW02	Lecture / Exercises / Laboratory	Credit / Examination	Internal, topical assessment
U2	A student who has passed the subject of PHYSICS is able to individually and as a team carry out basic physical measurements and process and present their results, in particular: - is able to build a simple measurement system with the use of standard measurement equipment, according to the given scheme and specifications, - is able to determine the results and uncertainties of direct and indirect measurements, - is able to assess the reliability of calculation results.	K_UW06 K_UO20 K_UO21	Laboratory	Credit / Examination	Entrance test, exercise report
U3	A student who has passed the subject of PHYSICS is able to plan measurements, use computer techniques to process and present measurement results, and interpret the obtained results in the context of his/her physical knowledge and draw conclusions.	K_UO20 K_UW12	Laboratory	Credit / Examination	Entrance test, exercise report

K1	A student who has passed the subject of PHYSICS is ready to work in a team, assuming specific roles and optimizing the division of tasks (especially in the laboratory) and being responsible for the results of his actions and for the process of continuous learning.	K_KK01 K_KK03 K_KK04	Laboratory	observation	Verbal evaluation

Literature and teaching aids
[1] University Physics Vol. 1,2,3. - OPENSTAX.ORG on-line and pdf handbooks: https://openstax.org/details/books/university-physics-volume-1 https://openstax.org/details/books/university-physics-volume-2 https://openstax.org/details/books/university-physics-volume-3 (plus Android and iPhone applications as well as PhET Colorado simulations). [2] Khan Academy Physics – video courses (https://www.khanacademy.org/science/physics/, https://www.khanacademy.org/science/in-in-class11th-physics) [3] T. Szumiata, Didactic web-page of subject coordinator (https://sites.google.com/view/didacticstadeuszszumiata). [4] Halliday D., Resnick R., J. Walker J., Fundamentals of Physics, 12th Edi., WILEY, 2021 (PRINT & E-BOOK). [5] Collection of Solved Problems in Physics - Charles University in Prague: https://physicstasks.eu/ [6] Laboratory of Physics – Illinois Tech (Illinois Institute of Technology): https://www.iit.edu/physics/student-resources/physics-123-laboratory-manual https://www.iit.edu/physics/student-resources/physics-221-laboratory-manual https://www.iit.edu/physics/student-resources/physics-223-laboratory-manual [7] Matlab – numerical calculations in Industry 4.0 standard (https://matlab.mathworks.com/). [8] SageMath/Python – online symbolic calculations in Industry 4.0 standard (https://sagecell.sagemath.org/) [9] PhET Colorado – online physics simulations (https://phet.colorado.edu/)

Student workload required to achieve the assumed learning outcomes – the balance of ECTS credits			
Attendance, participation	Student workload [h].		
	Other contact hours (IGK)	Student's self-study hours Classes without a teacher (ZBN)	Classes
Participation in ... lectures	X	X	30 [h]
Participation in .... classes/laboratory classes	X	X	60 [h]
Meeting with teachers during their duty hours	10 [h]	X	X
Preparation for lectures/classes/.... , Preparation for ... credit / exam	X	100 [h]	X
Total student workload	10 [h] / 0,4 ECTS	100 [h]/4 ECTS	90 [h] / 3,6 ECTS
ECTS credits for the course	8 ECTS		

Additional information, comments
In the case of students with special needs, including disabilities, and chronic illnesses, the methods and forms of verification of learning outcomes specified above (in the syllabus) are adapted to the individual needs of these students, as appropriate. Detailed rules and forms of support for students with special needs, including those with disabilities and chronically ill, during classes, credits, and exams are specified in: University Regulations (Regulamin Studiów Uniwersytetu Technologiczno-Humanistycznego w Radomiu), Study Regulations (Zasady Studiowania), and Procedure for Ensuring Accessibility of the Educational Process to Students with Special Needs, Including Those with Disabilities and Chronically ill (Procedura dotycząca zapewnienia dostępności procesu kształcenia studentom ze szczególnymi potrzebami, w tym: z niepełnosprawnością, przewlekle chorych).