

SYLLABUS

Course description

Course code		Course	FIZYKA		
ME/O/I/ST/A4			PHYSICS		
Language of instruction		English			
Academic year		2025/2026			
field of study:		Mechanical Engineering			
field of specialisation:		All			
Educational level		first-cycle studies			
Education profile		General academic			
Mode of study		Full-time studies			
Semester(s)		2, 3			
Affiliation with a group of classes		A. Group of basic course			
Course status		Obligatory			
Types of classes, instruction hours, ECTS credits		Types of classes	Number of instruction hours	Number of ECTS credits	
		Lecture	30 [h]	8 ECTS	
		Classes	30 [h]		
		Lab	30 [h]		
Linkage of the course	with the education profile	Related to the conducted scientific activity in the discipline to which the field of study is assigned			8 ECTS
	with qualifications	It is used to acquire engineering competences by the student			8 ECTS
	with science discipline	Mechanical engineering			8 ECTS
Form of teaching		Traditional – classes organized at the University /classes conducted using distance learning methods and techniques			
Prerequisites		No formal requirements (recommended knowledge in physics and mathematics at the level of the extended secondary school exam)			
Department		Faculty of Mechanical Engineering			
Coordinator		Assoc. prof. Tadeusz Szumiata, PhD.			
The website of the basic organizational unit		http://wm.uniwersytetradom.pl			
E-mail address, phone number of the coordinator		t.szumiata@urad.edu.pl, (48) 361-78-46			

LEARNING OUTCOMES, CURRICULUM CONTENT, TEACHING CLASSES, VERIFICATION OF LEARNING OUTCOMES

<p>Learning Objective:</p>	<p>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.</p> <p>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.</p>
<p>Curriculum Content:</p>	<p>The entire physics course - lecture, classes and laboratory - is related to basics of scientific research.</p> <p>The laboratory and some of the examples solved during the lecture and classes are related to the formation of practical skills.</p> <p>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.</p> <p>LECTURE [W1, W2, U1]:</p> <p>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.</p> <p style="text-align: right;">Total: 30 [h].</p> <p>CLASSES [W1, W2, U1]:</p> <p>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.</p> <p style="text-align: right;">Total: 30 [h].</p> <p>LABORATORY [W2, U1, U2, U3, K1]:</p> <p>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.</p>

	<p>Subsequent activities: students perform laboratory exercises in teams (5 exercises selected from the following list):</p> <ul style="list-style-type: none"> * 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 elements. * 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. <p style="text-align: right;">Total: 30 [h].</p>
Didactic (educational) methods:	<ul style="list-style-type: none"> - 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:	<p>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.</p> <p>The method of calculating the final grade for a subject is specified in the study regulations.</p> <p>The method of obtaining a grade for individual forms of classes is as follows:</p> <p><u>Passing of the classes:</u> obtaining the minimum number of points (50%) from the tests, taking into account additional points for activity in class.</p> <p><u>Passing the lecture:</u> obtaining a positive grade (equivalent to obtaining at least 50% of the maximum number of points) from the final written credit in the form of open questions, choice tests or calculation commands. 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 is to obtain a positive grade of the exercises (at least a "satisfactory grade" 3.0). 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, Python as well as wxMaxima and Calcpad).</p> <p><u>Passing laboratory classes:</u> obtaining at least 15 points from the performed exercises (grade calculated according to the regulations of the Didactic Physics Laboratory).</p>

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_WG01	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 measurement uncertainty and ways of determining them.	K_WG02, K_WG01	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_UW01, K_UW02, K_UW06	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_UW01, K_UW02, K_UW06	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-KK02, K_KO04	Laboratory	observation	Verbal evaluation
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Literature and teaching aids	
<p>Primary literature:</p> <p>[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</p> <p>[2] T. Szumiata, Didactic web-page of subject coordinator (https://sites.google.com/view/didacticstadeuszzsumiata).</p> <p>Additional literature:</p> <p>[1] Halliday D., Resnick R., J. Walker J., Fundamentals of Physics, 12th Edi., WILEY, 2021 (PRINT & E-BOOK). [2] Collection of Solved Problems in Physics - Charles University in Prague: https://physicstasks.eu/ [3] 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</p> <p>Study aids:</p> <p>[1] PhET Colorado – online physics simulations (https://phet.colorado.edu/) [2] Matlab – numerical calculations in Industry 4.0 standard (https://matlab.mathworks.com/). [3] Python - Python Programming And Numerical Methods: A Guide For Engineers And Scientists https://pythonnumericalmethods.studentorg.berkeley.edu/notebooks/Index.html [4] Calcpad - mathematical and engineering calculations: https://calcpad.eu/ [5] wMaxima for symbolic algebra and calculus: https://wxmaxima-developers.github.io/wxmaxima/</p>	

Student workload required to achieve the assumed learning outcomes – the balance of ECTS credits		
Attendance, participation	Student workload [h].	
	Student's self-study hours Classes without a teacher (ZBN)	Classes
Participation in lectures/classes/lab	X	90[h]
Preparation for lectures/classes/lab ,	110 [h]	X
Total student workload	110 [h]/ 4.5ECTS	90 [h]/ 3.5ECTS
ECTS points per subject	8 ECTS	

Additional information, comments
<p>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.</p> <p>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).</p>