Subject (course) name: **Physics**		
Programme: **Electrical Engineering** Specialty:		Subject code: **2W**
		Title graduate: **Engineer**
Type of course: **obligatory**	Course level: **First-cycle studies**	Year: **I** Semester: **I** Semester: **winter**
Form of classes: **Lectures, Classes, Labs, Seminar, Project**	Number of hours per week: **2L^{E}, 2C, 1Lab, 0, 0**	Credit points: **6 ECTS**

GUIDE TO SUBJECT

SUBJECT OBJECTIVES

C1. Introduction of students with basic principles of general physics.

C2. Introduction of students with the basic principles and rules of general physics.

C3. Learning of students experiences of application of theoretical background for resolving of the tasks for the concrete physical branch. Studies of application of theoretical background to solving of the tasks for the given branch of physics. This one include not only teaching of the concrete methods of the solving the tasks which consist in the reduction of the tasks to more simple model.

C4. Teaching by students of applying the principal physical units in the standard system CI.

C5. Study by the students the metrology of general physics for evaluation of the concrete parameters and physical constants within a framework of the lecture topics as well as theoretical backgrounds of laboratory experiments.

C6. To study by students an experience of performance of measurements and design of experimental set-up.

C7. Study by students of analytical description of the obtained results including the statistical treatment.

SUBJECT REQUIREMENTS

1. The knowledge covering middle age school level.
2. Mathematical analysis covering differential and integral calculations. The latter should be ahead of physical laboratory (the evaluations of measurement accuracies).
3. An experience in use of mathematical methods covering the program of middle age school.
4. An experience of individual work and in the group.
5. Preparation of report from laboratory tasks.
6. An experience in the exploitation of personal computer as well as some graphical programs to define regression coefficients and the graphics of Basic mathematical functions.

LERNING OUTCOMES

EK 1 – Student knows and understands basic principles of general physics.

EK 2 – Student knows and understands basic rules of general physics.

EK 3 – Student knows and understands basic phenomena and physical processes.

EK 4 – Student is able to interpret physical sense of a process in a from of mathematical equation.

EK 5 – Student Has an knowledge concerning set-up and methods of studies of physical objects possessing different degree of condensation.

EK 6 – Students is able to resolve individually the general physics tasks.

EK 7 – Student is able to do measurements of physical magnitudes.

EK 8 – Student is able to work in physical group.

EK 9 – Student is able to prepare correctly report concerning the conducted laboratory exercises following an example.

SUBJECT CONTENT

Form of classes - lectures

Topic	Hours
W1 – Elements of physical methodology and physical units. Scalar, vector, system of coordinates, Representations of vectors in different coordinates, scalar and vector multiplications. Definition of derivatives, integrals and calculations of derivatives.	**4**
W2 – Definition of movement (vector-position, velocity and acceleration) for the uniform and rotation movement. Definition of pulse and force (pulse and force moments). Inertial and non-inertial systems. Principles of Newton dynamics. Gravitational rules. Kinetics energy for uniform and rotational movement. Potential energy (gravitational and decoupled parts). Principles of pulse and mechanical energy conservations. The movement in the field for the case of central forces. Keppler rule.	**4**
W3 – Body arrays. Interactions of two bodies (elastic and inelastic, central and non-central). Kinematics and dynamics of rigid solid bulks. Gyroscopic effects. ,	**2**
W4 – Elements of mechanics and relativistic optics. Relativistic principles of Galileum. Lorentz transformation and their consequences with respect to length time and masses. The velocity transformation. Relativistic energy.	**2**
W5 – Elements of vibration physics. Simple harmonic vibration and its features. Harmonic oscillator and energy conservation for oscillator. Mathematical and physical pendulum. Stimulated vibrations. Resonances. Electrical resonances. Electrical vibration circuits.	**2**
W6 – Elements of molecular physics and thermodynamics. Hydrostatics. Molecular kinetics theory of perfect gaseous. Thermodynamical principles. Gaseous transformations. Changes of body condensations. Calorimetric features of condensed matter and liquids.	**2**
W7 – Basic principles of electrodynamics and magnetism. Basic rules of electrodynamics and magnetism. The row principles concerning electrical and magnetic fields and the physical units. Gauss rule. Movement of the charge particle as well as conductors in magnetic field. Maxwell equations.	**6**
W8 – Geometry and wave optics. Geometry optics rules. Effect of complete internal reflection. Lenses, mirrors and optical set-up. Diffraction and interference effects. Polarization of light.	**2**
L9 – Acoustical principles. Features of sound. Decibel scale. Levels of reference. Pressure references, sound reference level.	**2**
W10 – Principles of atomic physics. Emission of of the perfect black body. Photoelectrical effect. X-ray emission. Bohr model for hydrogen. De Broigle rule. Heisenber indeterminacy principle. Schrodinger equation. Wave function.	**2**
W11 – Introduction to nuclear physics, The structure of nucleus. Mass defect and bonding energy in nuclear physics. Nuclear decay and nuclear reaction. Construction and principles of fictionalization of nuclear devices. The protection against the nuclear illumination.	**2**
Total	**30**

Form of classes – practical exercises

Topic	Hours
C1 – Introduction to vector analysis (basic vector operation, scalar and vector multiplication, vector fields: gradient, divergence, rotors)	**2**
C2 – Kinematics of material point (one-dimensional, movement on the plane, projections).	**2**
C3 – Dynamics of materials point. (principles of Newton dynamics, type of forces, dynamics)	**2**
C4 – Work done by the fixed and variable force, kinetic energy, potential, power, the principle of conservation of mechanical energy). Momentum, principle of conservation of momentum, elastic and inelastic collisions.	**2**
C5 – Kinematics and dynamics of rotational motion of a rigid body, moment of inertia.	**2**
C6 – Gravity (the law of universal gravitation, gravitational potential energy, Kepler's laws, speed of cosmic).	**2**
C7 – Final test	**2**
C8 – Vibration (simple harmonic motion, energy in motion simple harmonic motion damped resonance).	**2**
C9 – Electrostatics (Coulomb's law, the movement of a point charge in an electric field, capacitors: capacitance, including the capacitor and the energy stored in the electric field of a capacitor).	**2**
C10 – DC Circuits (intensity and density of electric current, resistance, resistivity and conductivity, Ohm's law and including resistors, complex circuits: Kirchoff's laws)	**2**
C11 – The magnetic field (magnetic field and its characterization, movement of a point charge in a magnetic field, magnetic flux, and the right Ampère)	**2**
C12 – Thermodynamics (equation of state of a perfect gas, gas conversion, heat, energy and work in the transformation of the gas, the first and second law of thermodynamics).	**2**
C13 – Optics (law of refraction, lenses, wave nature of light)	**2**
C14 – Elements of modern physics (quantum nature radiated electromagnetic hydrogen, mass and energy relativistic)	**2**
C15 – final test	**2**
Total	**30**

Form of classes - laboratory

Topic	Hours
L1 – Classes organizational. Getting Acquainted with health and safety regulations in force in the physical laboratory. Principles of laboratory exercises and preparing the reports.	**2**
L2 – Measurements. Error measurements. Sources of error (uncertainty) measurement. Distribution of errors. Readability and accuracy class of the instrument. Rounding the results of measurement and rounding rules. Standard deviation. The average value of measurements of the same accuracy. The size of the mean square error of a single measurement in the series and the mean square error of the mean. The mean square error size of the complex. Student's method for determining the error small series of measurements. Linear regression.	**2**
L3 – Graphical methods of presenting results. Implementation of the chart, matching the scale and application of measurement points. Rectangle error. Read the value from the graph and determine the slope of the curve.	**2**
L4 – Determination of the selected spring constant of the springs.	**2**
L5 – Determination of the acceleration of gravity using pendulum.	**2**
L6 – Determination of internal resistance of the cell.	**2**
L7 – Determining resistivity of selected materials.	**2**
L8 – Determination of capacitance and dielectric constant of the capacitor flat.	**2**
L9 – Determination of capacitance and dielectric constant of the capacitor flat.	**2**
L10 – Marking the thermocouple and thermistor.	**2**
L11 – Measuring the speed of sound in air using oscilloscope.	**2**
L12 – Determination of impedance and reactance in circumference AC RLC for mixed loads.	**2**
L13 – Determining the focal length of the lens focusing and scattering by Bessel.	**2**
L14 – Determination of the refractive index of transparent materials selected.	**2**

L15 – Checking the Malus law.	**2**
Total	**30**

STUDY METHODS

1. The lecture and multimedia presentation
2. Exercise auditorium: solving on the board of accountancy tasks previously communicated in the form of a letter.
3. Laboratory - measurements by two-person teams student under the supervision of the teacher.
4. Talk solvability and methods of solution of selected problems

EDUCATIONAL TOOLS

1. Multimedia projector and screen
2. Blackboard, chalk
3. Sets of tasks to solve
4. Textbooks and scripts
5. Sets of laboratory exercises

METHODS OF ASSESMENT (F - forming, P - SUMMARY)

F1. Readiness Assessment Exercise auditoria
F2. Rating ability to apply theoretical knowledge to solve problems
F3. Evaluation of activity in the classroom
F4. Evaluation of preparation for laboratory-oral answer
F5. Rating timely preparation of reports on the implementation of laboratory exercises
P1. Lecture: assessment of mastery learning material that is the subject of the lecture - oral exam
P2. Exercise auditorium: credit grade - colloquia
P3. Laboratory: final assessment consists of: demonstrating skills and activities during the execution of the exercise, the quality of reports made and the number of exercises

STUDENT WORKLOAD

activity	Average number of hours / credits to complete the activity		
	[h]	∑ [h]	ECTS
Participation in class activities lecture exercises laboratory	30 30 30	90	4
Getting Acquainted with the indicated literature	5	60	2
Preparing for classes auditorium	10		
Preparing for laboratory classes	10		
Preparing reports of laboratory	15		
Preparing to colloquia classes auditorium	10		
Preparing for the exam	10		
TOTAL		**150**	**6**

A. BASIC READING

1. R. Resnick, D. Halliday, J. Walker: Fundamentals of Physics Extended, 8TH ED, Wiley, 2008.
2. D. Halliday: Physics, VOL. 1, 5TH ED, Wiley 2008.
3. J. Orear: Fundamental Physics, Wiley 1961.

B. FURTHER READING

1. M. Skorko: Fizyka, PWN, Warszawa,
2. J. Araminowicz: Zbiór zadań z fizyki, PWN, Warszawa 1996.
3. J. R. Taylor: Wstęp do analizy błędu pomiarowego, PWN, Warszawa 2011.
4. R. Respondowski: Laboratorium z fizyki, Wydawnictwo Politechniki Śląskiej, Gliwice 1999.

Learning objectives	In relation to the learning	Objectives of the course	Study methods	Methods of assessment

	outcomes specified for the field of study			
EK1	KE1A_W02	C1	lecture	F3, P1
EK2	KE1A_W02	C2	lecture	F3, P1
EK3	KE1A_W02 KE1A_W04	C1	lecture	F3, P1
EK4	KE1A_W02	C1,C2, C4	lecture exercises	F1, F2, F3, P1, P2
EK5	KE1A_U12		lecture laboratory	F3,
EK6	KE1A_W02	C1, C2, C3, C4	exercises	F1, F2, F3, P2
EK7	KE1A_W05 KE1A_W08 KE1A_U07	C2, C6, C7	laboratory	F4, F5, P3
EK8	KE1A_K03	C5	laboratory	P3
EK9	KE1A_U013 KE1A_K04	C1, C2, C3, C7	laboratory	P3

II. EVALUATION

Grade	Outcome
EK1	**The student knows and understands basic grasp of general physics**
2	A student can not name and define the basic concepts of physics chosen overall.
3	Student is able to replace some of the basic concepts of general physics.
4	The student is able to present a formula selected concept of general physics and provide its basic unit
5	The student can describe strictly arbitrary concepts of general physics.
EK2	**The student knows and understands the basic principles of law of general physics**
2	A student can not name and define the choice of law, the principles of general physics.
3	Student is able to replace and partly explain the chosen law, the principles of general physics, but do not always understand their meaning.
4	Student is able to list and describe in strictly selected laws and principles of general physics and understand their meaning.
5	The student is able to solve technical issues based on any laws of physics.
EK3	**The student knows and understands the basic phenomena and physical processes taking place in its environment**
2	A student can not name and define any basic physical phenomena and processes.
3	The student is able to exchange and discuss in part the course of selected phenomena or physical processes, but does not always understand their meaning.
4	The student is able to exchange and discuss closely the course of the selected phenomenon or physical process.
5	Student is able to resolve technical issues and tasks of the problem on the basis of any physical phenomena and processes.
EK4	**The student is able to interpret the physical equations presented in the form of a mathematical formula**
2	The student is able to interpret the physical equations presented in the form of a mathematical formula
3	The student is able to interpret the physical only certain types of physical equations, speaking of the mutual relationships between values, causes and consequences of interactions.
4	Student is able to make a physical interpretation of most types of physical equations speaking about mutual relationships, physical dependent and independent variables and constants, and interpretation of mathematical allowing to determine the numerical value of a quantity treated as a number of detached.
5	The student also can based on the received unit of the physical quantity to define it.
EK5	**The student has knowledge of the tools and methods of the bodies found in various states of concentration and their basic physical**
2	The student has not mastered the knowledge of the tools and methods of the bodies found in various states of aggregation and their basic physical properties
3	Student is able to name just some of the tools and research methods used to study the bodies found in the selected state of aggregation and can make a basic characterization of the properties of such bodies.
4	Student is able to replace the tools and describe the methods of research bodies occurring in any state

	of aggregation and closely characterize their physical properties.
5	Student is able to make a comparative analysis of test methods and physical properties of bodies occurring in any state of aggregation.
EK6	**The student has the ability to independently solve problems of general physics**
2	Students can not apply the theoretical knowledge learned to solve the task of the board of physics.
3	The student can solve (analyze the content, write the data contained and the resulting content of tasks, standardize units to SI unsubscribe sized searched, unsubscribe or infer the relationships between magnitudes occurring in the task, rights and principles in the form of equations, do any drawings to facilitate the solution of the auxiliary and solve the task in the physical symbols) selected accounting tasks in physics,
4	Student is able to solve any task accounting of physics checking units designated symbols and calculation of numerical values across size.
5	Student is able to further analyze the physical meaning of the resulting solution to any task.
EK7	**The student is able to perform measurements of the size and physical characteristics**
2	The student is not able to perform measurements of the selected size or physical characteristics
3	The student is able to perform measurements of the selected size and physical characteristics using simple instruments and measurement methods.
4	The student is able to perform measurements of the selected size and physical characteristics of the use of specialized instruments and methods of measurement and interpret them.
5	The student can also draw the right conclusions from the measurements of any size and physical characteristics
EK8	**Student is able to work in a team research**
2	The student does not participate in the work of the team
3	A student takes part in some of the work team
4	Student can take different roles in the course of teamwork
5	Student is able to manage a team and coordinate its actions at each stage
EK9	**Student is able to correctly prepare a report on laboratory exercises performed in a predetermined pattern**
2	The student is unable to prepare a report on laboratory exercises performed in a predetermined pattern
3	Student is able to develop the theoretical part of the report contains a description of the phenomenon (the object) and the definition of the physical size of the physical and description used in the exercise, a specific measurement method and a description of the regimen used measurement system. Able to clearly formulate goals exercise, write computational models using physical quantities appearing in the tables of measurement to describe the course of the measurements.
4	The student can also make a correct evaluation of measurement uncertainty (error evaluation) of the measured indirectly using appropriate methods used for their estimates and calculations (including with respect to charts). Able to properly store the result of measurement (the average value and its uncertainty) in accordance with the principle of rounding.
5	A student on the basis of the results obtained can draw correct conclusions from the conducted experiments and determine what factors, instruments and measurement methods could have an impact on improving the accuracy of the measurement.

III. OTHER USEFUL INFORMATION

1. All information for students on the schedule are available on the notice board and on the website: www.el.pcz.pl
2. Information on the consultation shall be provided to students during the first lecture and will be placed on the website www.el.pcz.pl
3. Terms and conditions of credit courses will be provided to students during the first lecture