SYLLABUS

Name: ***Physics (AESAu>SI3Phy24)***
Name in Polish:
Name in English: ***Physics***

Information on course:

Course offered by department: Faculty of Automatic Control, Electronics and Computer Science
Course for department: Silesian University of Technology

Default type of course examination report:

EGZ

Language:

English

Course homepage:

https://platforma.polsl.pl/rif/course/view.php?id=369

Short description:

The aim of the course is to explain students the fundamental physical phenomena using main scientific concepts. The students are acquainted with the basic laws and principles of classical and modern physics applying mathematical tools and modelling. The practical aspects of implementation of physics knowledge of natural laws in technology and everyday life are discussed. The students` skills to measure the physical values and their application in solving engineering problems are developed. The course serves as foundation to more specialized courses related to automation and electronics.
Pre-requisite qualifications: algebra, calculus, vector analysis, high-school physics. Course attendants should possess satisfactory knowledge of vector operations, derivatives and integrals. Students are able to apply basic computer programming, multimedia, use various information sources (textbooks, manuals, encyclopedias, network resources) and communicate in English language.

Description:

ECTS: 6
Total workload: 170h (90 contact hours, 80 students` own work hours)
Form of contact hours:
Lecture 30h
Classes 15h
Laboratory 30h
Other (e.g. tests and laboratory report revisions/discussions) 15h

Student's own work: preparation for tests, writing reports

The Physics course contains: lectures (including demonstrations with student active involvement), classes (solutions of numerical tasks by students under teacher direction) and laboratory (experiments in student groups).
The lectures (L) include hands-on demonstrations, which illustrate the physical phenomena and laws and their practical applications. The students take part actively in the demonstrations and then prepare reports using registered photos and films.
Classes (C) are devoted to solving and discussion of numerical tasks. The task sets are correlated with the lectures and made available to the students in advance (at the Distance Education Platform). The students can also individually discuss with a teacher their problems with solutions during the consultation hours.
Laboratory experiments (L) are performed in the 2-3 person groups. It contains: theoretical test, performing 6 chosen experiment, elaboration obtained results, calculation uncertainties and preparing a report.

Lecture topics:
1. Electrostatic field in a vacuum, Coulomb's law and the principle of superposition
2. Gauss's law for an electrostatic field
3. Potential of the electrostatic field and potential energy
4. Conductor in the electric field. Electric capacity. Capacitors. Electrostatic field energy. Electric properties of matter. Dielectrics. Polarization of dielectrics
5. Classical theory of electrical conductivity of metals, liquids and gases
6. Magnetic field. Biot - Savart law. Ampere's law. Electrodynamic force. The magnetic moment
7. The force acting on the charge moving in the magnetic field. Applications in technology
8. Magnetic properties of matter. Vector of the magnetic field strength
9. The phenomenon of electromagnetic induction and its applications. Self-induction and inductance. Circuit with inductance L and resistance R. Variable electric field as a source of magnetic field. Maxwell's equations
10. The energy of the magnetic field. Electromagnetic waves. Wave equation, spectrum and properties of electromagnetic waves.
11. Quantum model of electromagnetic radiation. Photons. The photoelectric effect.
12. Thermal radiation. Planck distribution. Stefan - Boltzmann law. Elements of solid state physics.

Laboratory https://platforma.polsl.pl/rif/course/view.php?id=8
List of experiments
1. Determination of Earth’s gravitational acceleration using a simple pendulum.
2. Determination of sound velocity in air using a Quincke tube.
3. Analysis of harmonic vibrations of a guitar string.
4. Determination of viscosity coefficient in air using a capillary.
5. Determination of liquid density using a Westphal balance.
6. Determination of the density of materials using regular solids.
7. Determination of the diffraction grating constant.
8. Characteristics of a phototube.
9. Investigation of the Hall effect.
10. Determination of the energy band gap in a thermistor.
11. Determination of the specific charge of electron by the transverse magnetic field method.
12. Resonance in a series LC circuit.

Bibliography:

Primary materials:
University Physics, W. Moebs, S. J. Ling, J. Sanny, 2016:
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
Boguslawa Adamowicz, Lecture presentations, The Distance Education Platform, Silesian Univ. of Technology; https://platforma.polsl.pl/rif/course/view.php?id=369
Supplemental materials:
D. Halliday, R. Resnick, J. Walker, Fundamentals of Physics, John Wiley & Sons, 12th ed. 2021
M. Mansfield, C. O'Sullivan, Understanding Physics, John Wiley & Sons, Chichester, 1998
J. Orear, Physics, John Wiley & Sons, New York, 1961
P. A. Tipler, G. Mosca, Physics for Scientists and Engineers, W. H. Freeman and Company
Laboratory materials (pdf files): Principles of data analysis, Guide to the expression of uncertainly, Laboratory instructions_https://platforma.polsl.pl/rif/course/view.php?id=8

Learning outcomes:

At the completion of the course, the student:
- knows the fundaments on electric and magnetic fields, elemental particles, waves, optics and elements of quantum physics, which are important for understanding and solving the engineering problems specific to automation and electronic systems; knows the principles of planning and carrying out the physical measurements as well as processing the obtained data including the determination of the measurement uncertainty (tests of tasks, final theoretical test) K1A_W1.

Assessment methods and assessment criteria:

The Physics course (3rd semester) consists of three components: lecture, classes and laboratory. According to SUT regulations, lecture attendance is optional (however, highly recommended), whereas classes and laboratory are obligatory.
Students need to pass the 2 tests related to classes (C) and a written exam on lecture (L) topics, i.e. the students` analytical/calculation skills (C) and their understanding of fundamental physical laws (L) are assessed.
The C grade is estimated on the basis of 2 calculation tests (each contains 4 tasks to solve; estimation in given in points; minimum necessary for passing classes is 50% of the point sum of both test; possible are group/individual retakes) as well as individual student activity during classes and written solutions of tasks (in the electronic form).
The written L test contains a set of questions which requires short consistent answers (both theoretical and descriptive elements are taken into account). The L grade contains also the results of group reports (a group consists of 2 - 4 students) on the lecture demonstrations illustrating various physical phenomena (the students take active part and register the demonstrations).
The score of written reports (in the electronic form) can reach maximum 20% of the overall score.
The grade of the laboratory (Lab) is positive when a student passes all assumed experiments (6).
The total final grade of Physics FG (3 – 5 scale) is calculated as an average of C, L and Lab grades, as follows: FG = 0.4*Classes + 0.3*Lecture and 0.3*Lab
The final average grade is rounded as follows:
[3.00 - 3.25] - 3.0
[3.26 - 3.75] - 3.5
[3.76 - 4.25] - 4.0
[4.26 - 4.75] - 4.5
[4.76 - 5.00] - 5.0
The syllabus is valid from the academic year 2024-2025 and its content cannot be changed during the semester.

Course credits in various terms:

<without a specific program>

Type of credits	Number	First term	Last term
European Credit Transfer System (ECTS)	6	2024/2025-Z	