SYLLABUS

Name: ***Physics (MakAu>SI2PHY19)***
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:

ZAL

Language:

English

Course homepage:

https://platforma.polsl.pl/rif/course/view.php?id=146

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: 3
Total workload: 90h (50 contact hours, 40 students` own work hours)
Form of contact hours:
Lecture 30h
Classes 15h
Other (e.g. tests revisions and discussions) 5h

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

The Physics course contains: lectures (including demonstrations with student active involvement) and classes (solutions of numerical tasks by students under teacher direction).
Lecture topics:
1. Physics as a natural science and the basis of technology. Physical units and the SI system. Vector and scalar values in Physics. Kinematics of a material point, velocity, acceleration (tangential and radial), trajectory.
2. The basics of classical mechanics. Dynamics of a material point. Newton's laws of dynamics. The principle of conservation of momentum.
3. The law of universal gravitation. Motion of bodies in a gravitational field; satellites.
4. Inertial and non-inertial reference frames, fictitious forces. Work, kinetic and potential energy, power. The principle of conservation of energy.
5. Dynamics of a rigid body. Torque, moment of inertia and angular momentum. The second law of dynamics of a rigid body, the principle of conservation of angular momentum.
6. Motion of a particle system. The center of mass. Elastic and inelastic collisions.
7. Harmonic oscillations: simple, damped and forced oscillators. Resonance.
8. Acoustic waves in the elastic medium and gases. Wave equation. Interference of waves. The standing wave. Doppler effect.
9. The ideal gas model. Elements of statistical physics. Pressure and temperature; gas state equation.
10. The principle of equipartition of energy. Heat, work and internal energy. The first law of thermodynamics. Specific and molar heat of gas. Real gas.
11. The second law of thermodynamics. Carnot cycle. Entropy.

The lectures 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 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.

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

Learning outcomes:

At the completion of the course, the student:

- knows and understands fundamental topics in Physics, in the field of kinematics, dynamics of a material point/rigid body, oscillations/ waves and thermodynamics, which are useful for formulating and solving typical engineering tasks that are specific to automation systems and electronic circuits (tests of tasks, final theoretical test) K1A_W03,
- is able to apply the known mathematical tools (vector operations, calculus, matrix calculus) for the description and analysis of the fundamental physical and technical problems (tests of tasks, final theoretical test) K1A_U09, K1A_U12

Assessment methods and assessment criteria:

The Physics course (2nd semester) consists of two components: lecture and classes. According to SUT regulations, lecture attendance is optional (however, highly recommended), whereas classes are obligatory.
Students need to pass the tests both related to classes (C) and lecture (L) topics, i.e. the students` analytical/calculation skills (C) and their understanding of fundamental physical laws (L) are assessed. The final grade FG (3 – 5 scale) is calculated as an average of C and L grades, as follows: FG = 0.6*C + 0.4*L.
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 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)	3	2020/2021-L	