COURSE DESCRIPTION CARD - SYLLABUS

Course name

Physics

Course

Field of study

Aviation

Year/Semester

2 / 3

Area of study (specialization)

-

Profile of study

general academic

Level of study

First-cycle studies

Course offered in

Polish

Form of study

full-time

Requirements

compulsory

Number of hours

Lecture

15

Laboratory classes

0

Other (e.g. online)

0

Tutorials

15

Projects/seminars

0

Number of credit points

2

Lecturers

Responsible for the course/lecturer:

dr inż. Anna Modlińska

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Instytut Badań Materiałowych i Inżynierii Kwantowej,

ul. Piotrowo 3

Responsible for the course/lecturer:

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tel.: 61 6653222

Wydział Inżynierii Materiałowej i Fizyki Technicznej

ul. Piotrowo 3

Prerequisites

Student has basic knowledge in the field of mathematics, including algebra, analysis, theory of differential equations, probability studies, analytical geometry necessary to understand and describe the basic issues related to modern physics.

Student has knowledge in the field of physics, including the basics of classical mechanics, optics, electricity and magnetism, thermodynamics, necessary to understand the issues of modern physics.

Student is able to obtain information from the indicated sources of literature, the Internet and other sources. Student can use formulas, tables and technical calculations.

Student understands the need to expand their competences and is ready to cooperate in a team.

Course objective

1. Familiarizing students with the basic concepts and laws of modern physics, to the extent specified by the curriculum content appropriate to the field of study, including their applications in technical sciences.

2. Developing students' skills in solving problems in contemporary physics, perceiving its potential applications in the studied field.

3. Developing students' skills in using literature and other sources.

Course-related learning outcomes

Knowledge

1. has extended and in-depth knowledge of mathematics including algebra, analysis, theory of differential equations, probability, analytical geometry as well as physics covering the basics of classical mechanics, optics, electricity and magnetism, solid state physics, thermodynamics, useful for formulating and solving complex technical tasks related to engineering aeronautical and modeling

2. has ordered, theoretically founded general knowledge in the field of technology and various means of air transport, about the life cycle of means of transport, both hardware and software, and in particular about the key processes taking place in them

3. has ordered and theoretically founded general knowledge in the field of key technical issues and detailed knowledge of selected issues related to air transport, knows the basic techniques, methods and tools used in the process of solving tasks related to air transport, mainly of an engineering nature

4. has ordered, theoretically founded general knowledge covering key issues in the field of technical thermodynamics, fluid mechanics, in particular aerodynamics

5. has an ordered, theoretically founded knowledge in the field of engineering graphics and machine construction: technical drawing, object projection, basic principles of engineering graphics, the use of CAD (Computer Aided Design) graphic programs in the construction of machines

6. has detailed knowledge related to selected issues in the field of manned and unmanned aircraft construction, in the field of on-board equipment, control systems, communication and recording systems, automation of individual systems, has basic knowledge of flight simulation training devices and simulation methods used to solve air transport issues

7. has extended knowledge in the field of material strength, including the theory of elasticity and plasticity, stress hypotheses, methods of calculating beams, membranes, shafts, joints and other structural elements, as well as methods of testing the strength of materials and the state of deformation and stress in structures, and has basic knowledge of the main departments of technical mechanics: statics, kinematics and dynamics of a material point and a rigid body

8. has basic knowledge of metal, non-metal and composite materials used in machine construction, in particular about their structure, properties, methods of production, heat and thermo-chemical treatment and the influence of plastic processing on their strength, as well as fuels, lubricants, technical gases, refrigerants e.t.c.

9. has the ability to self-study with the use of modern teaching tools, such as remote lectures, websites and databases, teaching programs, e-books

Skills

1. is able to obtain information from various sources, including literature and databases, both in Polish and in English, integrate them properly, interpret them and make a critical evaluation, draw conclusions and exhaustively justify the opinions they formulate

2. is able to properly use information and communication techniques, applicable at various stages of the implementation of aviation projects

3. is able to properly select materials for simple aviation structures, and can indicate the differences between the fuels used in aviation

4. is able to communicate using various techniques in the professional environment and other environments using the formal notation of construction, technical drawing, concepts and definitions of the scope of the study field of study

5. can solve tasks using basic knowledge of aerodynamics, flight mechanics and body flow

6. is able to design means of transport with appropriate external requirements (e.g. regarding environmental protection)

7. can analyze objects and technical solutions, can search in catalogs and on manufacturers' websites, ready components of machines and devices, including means and devices, assess their suitability for use in their own technical and organizational projects

8. can use the language of mathematics (differential and integral calculus) to describe simple engineering problems.

9. is able to organize, cooperate and work in a group, assuming various roles in it, and is able to properly define priorities for the implementation of a task set by himself or others

10. is able to plan and implement the process of own permanent learning and knows the possibilities of further education (2nd and 3rd degree studies, postgraduate studies, courses and exams conducted by universities, companies and professional organizations)

Social competences

1. understands that in technology, knowledge and skills very quickly become obsolete

2. is aware of the importance of knowledge in solving engineering problems and knows examples and understands the causes of faulty engineering projects that have led to serious financial and social losses, or to a serious loss of health and even life

3. is aware of the importance of knowledge in solving engineering problems and knows examples and understands the causes of faulty engineering projects that have led to serious financial and social losses, or to a serious loss of health and even life

4. correctly identifies and resolves dilemmas related to the profession of an aerospace engineer

Methods for verifying learning outcomes and assessment criteria

Learning outcomes presented above are verified as follows:

1. Assessment of knowledge and skills at the written or oral exam based on the explanation of selected issues in modern physics.

2. Current assessment of student activity in the lecture.

Programme content

1. Elements of relativity theory. Theory of special relativity. Postulates of special relativity. Time dilation and contraction of length. Lorenz transformation. Relativity of speed. Relativistic Doppler phenomenon. Momentum and energy valid for all physically allowed speeds. Rest energy. Total energy.

2. Photons and waves of matter. Quantum of light. Photoelectric effect. Schrödinger equation. Heisenberg uncertainty principle. Reflection and tunneling from the threshold of potential.

3. Electron energy in a trap. Electron wave functions. An electron in a finite potential well. Two- and three-dimensional electron traps. The hydrogen atom as an electron trap. Borh model of the hydrogen atom.

4. Properties of atoms. Stern-Gerlach experiment. Magnetic resonance. Pauli exclusion principle. Construction of the periodic table. X-rays. Lasers.

5. Electrical properties of solids. Energy levels in crystals. Isolators. Metals. Occupation probability. Semiconductors and doping. p-n junction. Transistor.

6. Nuclear physics. Radioactive decay. Dating methodologies. Radiation dose measurements. Nuclear models.

7. Nuclear energy. Nuclear fission. Nuclear reactor. Nuclear fusion.

8. Fundamental interaction. Standard model. Elementary particles. Fermions. Bosons. Cosmology.

PART - 66 (THEORY - 11.25 hours)

MODULE 2. PHYSICS

2.2 Mechanics

2.2.1 Statics

Elements of the theory of stress, strain and flexibility: stretching, compression, shear and torsion;

Physical properties of solid, liquid and gaseous;

Pressure and buoyancy in liquids (barometers). [2]

Teaching methods

1. Lecture: presentation of program content in the form of a multimedia presentation, presentation of physical experiences in the form of multimedia films, simulation of physical phenomena using computer programs.

Bibliography

Basic

1. D. Halliday, R. Resnick, J. Walker, Podstawy Fizyki, t. 4 i 5, PWN 2014,

2. H. Haken, H. C. Wolf, Atomy i kwanty, PWN 2012,

3. J. Massalski, M. Massalska, Fizyka dla inżynierów, t. 1-2, WNT, Wydanie V.

Additional

1. D. Halliday, R. Resnick, J. Walker, Podstawy Fizyki, t. 1-3, PWN 2014,

2. I.W. Sawieliew, Wykłady z fizyki, t. 1-3, PWN 2013,

3. W. Moebs, S. J. Ling, J. Sanny, Fizyka dla szkół wyższych, t. 1-3, OpenStax, https://openstax.pl/pl

Breakdown of average student's workload

	Hours	ECTS
Total workload	50	2,0
Classes requiring direct contact with the teacher	30	1,5
Student's own work (literature studies, preparation for lectures, preparation for exam) [1]	20	0,5

[1] delete or add other activities as appropriate