COURSE DESCRIPTION CARD - SYLLABUS

Course name

Experimental physics

Course

Field of study	Year/Semester
Technical physics	1/2
Area of study (specialization)	Profile of study
	general academic
Level of study	Course offered in
First-cycle studies	polish
Form of study	Requirements
full-time	compulsory

Number of hours

Lecture	Laboratory classes	Other (e.g. online)
45		
Tutorials	Projects/seminars	
60		

Number of credit points

8

Lecturers

Responsible for the course/lecturer:

dr hab. Jacek Goc, prof. nadzw. PP

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Responsible for the course/lecturer:

Prerequisites

Knowledge: basic knowledge of mathematics (differential and integral calculus, operations on operators) and experimental physics (within the scope of semester 1).

Skills: the ability to solve elementary problems in physics based on the acquired knowledge, the ability to obtain information from indicated sources.

Social competences: understanding the need to expand one's competences, readiness to cooperate as part of a team.

Course objective

1. providing students with basic knowledge of classical physics, within the scope defined by the curriculum content appropriate for the field of Technical Physics

2. presenting students with basic physical phenomena and their theoretical description at the academic level in the field of mechanics, gravitational field, vibrations and waves in elastic media

3. developing students' skills to solve simple physical tasks and problems based on the acquired knowledge

4. improving students' literacy skills

Course-related learning outcomes

Knowledge

As a result of the conducted classes, the student:

1. has an ordered and theoretically founded basic knowledge in the field of experimental physics, including electromagnetic field, electromagnetic waves and geometric and wave optics [K1_W03],

2. knows the mathematical apparatus necessary to describe the basic laws of physics and solve problems related to physics, including: the basics of differential and integral calculus, linear algebra and analytical geometry [K1_W01].

Skills

As a result of the course, the student should demonstrate skills in the following areas (the student will be able to):

1. can use acquired mathematical knowledge to describe processes, create models, write algorithms in the field of technical physics; can use analytical methods to formulate and solve tasks in the field of electromagnetic field, electromagnetic waves and geometric and wave optics [K1_U01]

2. is able to obtain information from literature, databases and other sources, interpret them and draw conclusions, formulate and justify opinions [K1_U02]

3. has the ability to self-educate [K1_U03]

Social competences

As a result of the course, the student will acquire the competences listed below. Completing the course means that:

1. can work responsibly on the assigned task [K1_K01],

2. acts in accordance with the principles of professional ethics; is responsible for the reliability of the obtained results and their interpretation [K1_K02].

Methods for verifying learning outcomes and assessment criteria

Learning outcomes presented above are verified as follows:

Effect.	Form of evaluation.	Evaluation criteria
W01, W02, W03	written / oral examination	50.1% -70.0% (3)
U01, U02	written / oral examination	70.1% -90.0% (4)
	rating of answers to questions	from 90.1% (5)

U01, U02, U03	Colloquium	50.1% -70.0% (3)
		70.1% -90.0% (4)
		from 90.1% (5)
K01	of activity during calculation exercises	50.1% -70.0% (3)
		70.1% -90.0% (4)
		from 90.1% (5)

K01, K02, -student shows moderate commitment to solving problems, are encouraged to look for a solution based on acquired knowledge, to a limited extent engages in implementation of accounting exercises

(3) -student shows commitment to problem solving, actively looking for a solution based on the acquired knowledge engages in the implementation of accounting exercises

(4) -student shows great commitment to problem solving, independently looks for a solution based on the acquired knowledge, looking for additional sources of knowledge useful to solve the problem,

(5) -student is actively involved in the implementation of accounting exercises, he is looking solutions in non-standard situations

Programme content

1. ELECTRICAL FIELD I. Charge and matter. Quantum nature of charge. Principle of conservation of charge. Coulomb's law. Electric field strength. Examples of calculating the field strength (electric dipole, thin ring). A charged particle and a dipole in an electric field.

2. ELECTRICAL FIELD II. Electric field flux. Gauss's law. Gauss's law and Coulomb's law. Charge on an insulated conductor. Examples of the application of Gauss's law (uniformly charged sphere, infinitely extended plane).

3. HOMOGENEOUS AND NON-HOMOGENEOUS ELECTRICAL POTENTIAL. Relationship of the potential and field strength. Example of potential calculation: for a spherical charge cloud, electric dipole. Potential electricity. Tension and potential.

4. DIELECTRICS. Electric capacity. Three electrical vectors. Gauss's law for dielectrics. Electric field energy, capacitor energy. RC circuits. Piezoelectrics, ferroelectrics, electrets.

5. CLASSICAL THEORY OF METAL GUIDANCE. Free electrons. Current density. Ohm's law (field generalized). I (V) characteristics for different types of conductivity. Kirchoff's laws. The warmth of Joule Lentz. Carrier drift velocity. Temperature dependence of resistance. Superconductivity. Thermoelectric phenomena.

6. CHARGE DYNAMICS AND CURRENT CONDUCTOR IN ELECTRIC AND MAGNETIC FIELDS. Definition of magnetic induction. Lorentz strength. Gauss's law for magnetics. Action of a magnetic field on a conductor carrying a current. Hall effect. Charges circulating in orbits. Cyclotron.

7. LAW OF AMPER. BIOT-SAVARTA LAW.

8. ELECTROMAGNETIC INDUCTION. Faraday's law. Eddy currents. Mutual and self induction. Magnetic field energy. RL circuit.

9. MAGNETIC PROPERTIES OF THE MATTER. Three magnetic vectors. Paramagnetism, diamagnetism, ferromagnetism, nuclear magnetism.

10. ELECTROMAGNETIC VIBRATIONS. Simple LC harmonic oscillator. RLC damped harmonic oscillator. Forced vibrations and resonance. Vibrating systems with concentrated and distributed elements. Analogies between electromagnetic and mechanical vibrations.

11. MAXWELL EQUATIONS. Maxwell's equations in integral and differential forms. Maxwell's equations for vacuum and medium.

12. ELECTROMAGNETIC WAVES. Wave equation for vectors E and B. Energy density - Poynting vector. Transmission line. The radiation of the dipole antenna.

13. WAVE MODEL OF LIGHT. Light and the electromagnetic spectrum. Geometric optics; Fermat's principle. Speed of light. Huygens' principle. Dispersion. Basic laws of geometrical optics.

14. GEOMETRIC OPTICS. Mirrors, lenses, optical systems. Eye. Magnifier. Telescope. Microscope.

15. PHOTOMETRY. Visual and objective photometry. Luminescence. The colors. Optical illusions.

16. DISPERSION, INTERFERENCE OF LIGHT. Normal and abnormal dispersion. Emission and absorption spectra. Interference. The coherence of light waves. Interference in thin films. Newton's rings.

17. DIFFACTION, POLARITY OF LIGHT. Fraunhoffer and Fresnel deflection. Diffraction grids. Optical instruments resolving power. Light polarization. Double breakdown. Polarization by reflection and dispersion. Polarizers.

18. POLARITY OF LIGHT II. Circular and elliptical polarization. Forced birefringence. The Kerr and Cotton - Mouton effect. Twist of the plane of polarization. Faraday effect. Circular dichroism and magnetic circular dichroism.

19. QUANTUM MODEL OF LIGHT. Thermal radiation. Planck's law. Photoelectric phenomenon. Compton effect.

20. WAVE PROPERTIES OF PARTICLES. De Broglie's hypothesis. The uncertainty principle and the wave properties of particles. Electron microscope.

Teaching methods

1. Lecture: a multimedia presentation, illustrated with the examples given on the blackboard and the presented experiences.

2. Exercises, multimedia presentation, presentation illustrated with examples given on the blackboard and carrying out the tasks given by the lecturers - practical exercises.

Bibliography

Basic

1. D. Halliday, R. Resnick, J. Walker, Podstawy Fizyki, t. 3 - 5, PWN 2004.

1. E. M. Purcell, Elektryczność i magnetyzm (Berkley Physics Course), PWN 1975.

2. B. Fabiański, Z. Paczkowski: Zbiór zadań z fizyki, Warszawski Dom Wydawniczy 2000

3. J. Araminowicz: Zbiór zadań z fizyki, PWN 1998

4. A. Hennel, W. Krzyżanowski, W. Suszkiewicz, K. Wódkiewicz: Zadania i problemy z fizyki Tom 2 PWN 1974

Additional

1. R. P. Feynman i inni, Feynmana wykłady z fizyki, PWN 1971.

2. J. Orear - Fizyka, t.1, WNT 1990.

3. S. Szczeniowski, Fizyka doświadczalna, PWN 1972.

Breakdown of average student's workload

	Hours	ECTS
Total workload	195	8,0
Classes requiring direct contact with the teacher	111	5,0
Student's own work (literature studies, preparation for laboratory classes/tutorials, preparation for tests/exam, project preparation) [1]	108	4,0

[1] delete or add other activities as appropriate