GDAŃSK UNIVERSITY OF TECHNOLOGY

Subject card

Subject name and code	Physical methods of materials testing , PG_00058939		
Field of study	Fizyczne metody badań materiałów		
Date of commencement of studies	October 2024	Academic year of realisation of subject	2025/2026
Education level	first-cycle studies	Subject group	Obligatory subject group in the field of study Subject group related to scientific research in the field of study
Mode of study	Full-time studies	Mode of delivery	at the university
Year of study	2	Language of instruction	Polish
Semester of study	3	ECTS credits	2.0
Learning profile	general academic profile	Assessment form	assessment
Conducting unit	Institute of Nanotechnology and Materials Engineering -> Faculty of Applied Physics and Mathematics -> Wydziały Politechniki Gdańskiej		
Name and surname of lecturer (lecturers)	Subject supervisor	prof. dr hab. inż. Wojciech Sadowski	
	Teachers	prof. dr hab. inż. Wojciech Sadowski dr inż. Piotr Okoczuk dr hab. inż. Marcin Łapiński dr inż. Kamil Kolincio	

Lesson types

Lesson type	Lecture	Tutorial	Laboratory	Project	Seminar	SUM
Number of study hours	30.0	0.0	0.0	0.0	0.0	30

E-learning hours included: 0.0

eNauczanie source addresses:
Moodle ID: 2110 Fizyczne metody badań materiałów 2025
https://enauczanie.pg.edu.pl/2025/course/view.php?id=2110

Additional information:

Zajęcia prowadzone są w formie prezentacji wykładowej wraz z komentarzem.

Learning activity and number of study hours

Learning activity	Participation in didactic classes included in study plan	Participation in consultation hours	Self-study	SUM
Number of study hours	30	2.0	18.0	50

Subject objectives

The aim of the course is to present experimental methods used in materials research in the aspect of the physical interaction of electromagnetic waves, acoustic waves and various corpuscular particles with matter.

Learning outcomes

Course outcome	Subject outcome	Method of verification
[K6_W07] has systematic knowledge of the physical and chemical principles of nanotechnology (methods of obtaining nanostructures, types of nanostructures, their properties, basic research methods).	The student has systematic knowledge of the physical and chemical foundations of nanotechnology (basic research methods).	[SW1] Ocena wiedzy faktograficznej
[K6_W09] Has knowledge of the structure and operation of scientific instruments, measuring and test equipment and in the field of planning and conducting a physical experiment and critical analysis of its results.	The student has knowledge of the construction and operation of physical instruments, measuring and research equipment, as well as of conducting a physical experiment and critically analyzing its results.	[SW1] Ocena wiedzy faktograficznej
[K6_U02] can analyze and solve simple scientific and technical problems based on possessed knowledge, applying analytical, numerical, simulation and experimental methods.	The student is able to analyze simple scientific and technical problems based on existing knowledge, using analytical and experimental methods.	[SU3] Ocena umiejętności wykorzystania wiedzy uzyskanej w ramach przedmiotu

Subject contents

Introduction to the physical foundations of materials research.
Interaction of primary beams with matter: electromagnetic waves, acoustic waves, and corpuscular particles.
Optical studies microscopic methods. Acoustic and thermal studies.
Electrical studies.
Diffraction studies.
Studies of electronic structure.
Studies of magnetic properties.
Spectroscopic methods for chemical composition studies.
Optical spectroscopy and photometry. UV-Vis and FTIR spectroscopy.
Tunneling microscopy and spectroscopy.
Application of lasers in materials research.

Prerequisites and co-requisites

Fundamentals of materials science.
Introduction to nanotechnology.
Physics.

Assessment methods and criteria

Subject passing criteria	Passing threshold	Percentage of the final grade
Written assessment	60.0%	70.0%
Participation in classes	70.0%	30.0%

Recommended reading

Basic literature	Concise Encyklopedia of Materials Characterization. Ed. R.W. Cahn. Perrgamon Press, 1993.
Supplementary literature	Fizyczne metody diagnostyki medycznej i terapii. Pod red. A.Z. Hrynbkiewicza i E. Rokity. PWN, 2013. Encyklopedia of materials characterization. Surfaces, Interfaces, Thin Films. Ed. C.Richard Brundle et al. 1992.
eResources addresses	

Example issues/ example questions/ tasks being completed	Primary beam sources used in research; measurement signal detectors, measurement signal analyzers. Interaction of primary beams with matter: electromagnetic waves, acoustic waves, corpuscular particles: electrons, atoms, ions, protons, neutrons, positrons. Electrical studies: Ohm's law macroscopically and microscopically, two-point, four-point, and six-point methods, electrical conductivity and resistance as a tensor, Hall effect. Diffraction studies: X-ray diffraction of polycrystalline and single-crystalline samples, powder diffraction, the rotating crystal method, the Laue method, the Bragg method, and the Ewald construction. Electronic structure studies: ARPES spectroscopy. Magnetic properties studies: magnetization and magnetic susceptibility. Diffraction studies: X-ray diffraction of polycrystalline and single-crystalline samples, powder diffraction, rotating crystal method. Scanning probe microscopy techniques: surface morphology imaging techniques, SPM techniques for structural studies, SPM techniques for electrical and magnetic properties, tunneling spectroscopy. Laser applications in materials research
Practical activites within the subject	Not applicable

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