



Subject card

Subject name and code	, PG_00070392						
Field of study	Materials Engineering						
Date of commencement of studies	October 2023	Academic year of realisation of subject			2025/2026		
Education level	first-cycle studies	Subject group			Optional subject group 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	3	Language of instruction			Polish		
Semester of study	6	ECTS credits			4.0		
Learning profile	general academic profile	Assessment form			assessment		
Conducting unit	Department of Solid State Physics -> Faculty of Applied Physics and Mathematics -> Faculties of Gdańsk University of Technology						
Name and surname of lecturer (lecturers)	Subject supervisor	dr inż. Marek Chmielewski					
	Teachers	dr inż. Marek Chmielewski					
Lesson types	Lesson type	Lecture	Tutorial	Laboratory	Project	Seminar	SUM
	Number of study hours	15.0	0.0	30.0	0.0	0.0	45
	E-learning hours included: 0.0						
	eNauczanie source addresses: Moodle ID: 4820 Nieniszczące metody badań materiałów 2026 https://enauczanie.pg.edu.pl/2025/course/view.php?id=4820						
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	45	5.0	50.0	100		
Subject objectives	The aim of the course is to prepare the student for experimental work in the field of multi-path testing of materials using non-destructive diagnostic techniques used to study the physical properties of matter, state structures and to detect defects.						

Learning outcomes	Course outcome	Subject outcome	Method of verification
	[K6_W04] Knows selected aspects of construction and operation of scientific equipment in materials engineering.	The student knows the basics and possibilities of various measurement techniques, independently discovers and indicates the possibilities of their effective application in fields other than those covered in the laboratory. They learn about the possibilities of software for advanced digital signal processing.	[SW1] Assessment of factual knowledge
	[K6_U06] Can integrate obtained information, interpret it and draw conclusions, as well as formulate and justify opinions.	The student creates reports on their work in a manner appropriate for scientific documentation, is able to check the completeness and order of the theses presented in the study, has the ability to draw logical conclusions and is able to record this information in a legible and stylistically correct manner.	[SU5] Assessment of ability to present the results of task
	[K6_U02] Can operate typical laboratory equipment and analyze material tests	The student conducts and supervises measurement experiments used to assess the quality of the tested materials and determines and identifies defects in the tested material. He/she is able to operate measuring equipment designed for non-destructive testing.	[SU1] Assessment of task fulfilment
[K6_W06] Knows selected methods, techniques, tools and materials used in solving simple engineering problems within the scope of materials engineering.	When performing tasks related to laboratory topics, he learns the correct method of conducting experiments. He performs and understands the need for multi-faceted analysis of the results obtained. He correctly performs calibration procedures and effectively uses their results to determine the parameters of unknown elements under investigation.	[SW1] Assessment of factual knowledge	
Subject contents	<p>Course content – lecture The student will know non-destructive methods based on measurement of physical quantities such as the value of induction and magnetic field, the intensity of Barkhausen noise effect, magnetostrictive and ultrasonic wave pulses for materials parameters describing. Students will know the methodology of the study of thin coatings, he will testing methods of flaw detection of materials based on the measurement of electrical resistivity, magnetic properties, acoustic properties and internal friction. Lecture: During the lecture will presents subjects listed below Method of defectoscopy: Radiological method Endoscopes method Magnetic field leakage method Ultrasound method Eddy Current Method Acoustic emission method Other methods Material investigation methods: Radiological method of material investigation Ultrasound method Electromagnetic method Mechanical spectroscopy method Hardness measurement method Stress determination methods Radiological method of stress determination Neutronographical method of stress evaluation Ultrasound method Magnetic method, Barkhausen effect method</p> <p>Course content – laboratory During the laboratory, students will perform at least four practical exercises in the field of non-destructive testing, mainly using the magnetic properties of the tested materials. Measurements of the scattered magnetic field will be used in practice to locate and identify surface and subsurface defects. An introductory exercise on the practical application of the Barkhausen effect to determine stress distribution in the vicinity of welded joints, and the use of acoustic Barkhausen effect measurements to determine volumetric structural changes. Testing of materials using ultrasonic techniques, use of eddy currents in defectoscopy and determination of the properties of the tested materials.</p>		
Prerequisites and co-requisites	Not required		
Assessment methods and criteria	Subject passing criteria	Passing threshold	Percentage of the final grade
	Labor	100.0%	60.0%
	Lecture	50.0%	40.0%
Recommended reading	Basic literature	Handbook of measurements of residual stresses; ed. J. Lu; The Fairmont Press, Articles from NDT&E Journal	
	Supplementary literature	No recommendations	
	eResources addresses		
Example issues/ example questions/ tasks being completed	<p>Detection and registration of ultrasound pulses.</p> <p>Measurement of the magnetic field leakage and its use in the defect detection.</p> <p>Barkhausen effect used in the field to determine the size for elastic deformation.</p>		
Practical activities within the subject	Not applicable		

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