GDAŃSK UNIVERSITY OF TECHNOLOGY

Subject card

Subject name and code	, PG_00071085		
Field of study	Civil Engineering		
Date of commencement of studies	October 2022	Academic year of realisation of subject	2025/2026
Education level	first-cycle studies	Subject group	Optional subject group
Mode of study	Part-time studies	Mode of delivery	at the university
Year of study	4	Language of instruction	Polish
Semester of study	8	ECTS credits	2.0
Learning profile	general academic profile	Assessment form	assessment
Conducting unit	Department of Engineering Structures -> Faculty of Civil and Environmental Engineering -> Faculties of Gdańsk University of Technology		
Name and surname of lecturer (lecturers)	Subject supervisor	dr inż. Dariusz Kowalski	
	Teachers	dr inż. Dariusz Kowalski	

Lesson types

Lesson type	Lecture	Tutorial	Laboratory	Project	Seminar	SUM
Number of study hours	10.0	0.0	10.0	0.0	0.0	20

E-learning hours included: 0.0

eNauczanie source addresses:

Moodle ID: 4353 2025_2026 Nieniszczące metody badań konstrukcji metalowych inż. ns
https://enauczanie.pg.edu.pl/2025/course/view.php?id=4353

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	20	0.0	0.0	20

Subject objectives

Introducing students to the principles governing the selection and application of non-destructive testing (NDT) methods for evaluating the quality of welded joints and components of metal structures. Developing the ability to interpret test results and understand the normative requirements related to the acceptance of metal structures.

Learning outcomes

Course outcome	Subject outcome	Method of verification
[K6_U05] Conducts research (obtaining information, simulations, experimental methods) in the field of construction in order to solve specific tasks and report research results.	The student is able to select and apply appropriate non-destructive testing methods (VT, PT, MT, RT, UT) for evaluating welded joints and metal structural components, and to prepare a professional NDT test report.	[SU3] Assessment of ability to use knowledge gained from the subject [SU4] Assessment of ability to use methods and tools
[K6_W03] Demonstrate knowledge and understanding of the processes, established standards and design methods in the civil engineering subject area and of their limitations.	The student demonstrates knowledge and understanding of standards, guidelines and design/ manufacturing processes applicable to metal building structures, including NDT requirements, and is aware of their limitations.	[SW1] Assessment of factual knowledge
[K6_K04] Engages in independent lifelong learning and individually follows the development of science and technology in the field of civil engineering.	The student recognizes the need for continuous professional development in non-destructive testing and independently follows technological advancements in NDT applied in civil engineering.	[SK5] Assessment of ability to solve problems that arise in practice [SK2] Assessment of progress of work
[K6_K03] Can effectively, clearly and unambiguously convey information, describe activities and communicate their results/ outcomes to engineers or a wider audience using appropriate communication methods and tools.	The student is able to communicate NDT results and technical information clearly and effectively to engineers, inspectors, and broader audiences using appropriate technical communication methods	[SK4] Assessment of communication skills, including language correctness
[K6_K01] Is aware of the key aspects of professional, ethical and social responsibility related to management, business operation, decision making and opinion formulation in civil engineering.	The student is aware of the key aspects of professional, ethical, and social responsibility associated with evaluating metal structures, issuing technical opinions, and making safety-related decisions.	[SK4] Assessment of communication skills, including language correctness [SK5] Assessment of ability to solve problems that arise in practice

Subject contents

Course content – lecture

Fundamentals of NDT in metal structures: scope of testing, quality requirements, standards, and regulations.
The welding process as a source of imperfections; classification of discontinuities according to PNEN standards.
Overview of non-destructive testing methods: VT, PT, MT, RT, UT.
Advanced techniques and structural diagnostics.
Acceptance requirements, documentation, and quality assurance systems (EN 1090).
Inspection and Test Plans (ITPs) for metal structures."

Course content – laboratory

Workshop Metrology: Measurement of geometric features of structural elements using various measuring instruments (gauges, calipers, micrometers, angle meters).

Visual Testing (VT): Determination of weld joint dimensions using a weld gauge and angle meter. Identification and classification of discontinuities detectable by VT in accordance with PNEN standards.

Penetrant Testing (PT): Performing PT on welded samples, interpretation of indications, and preparation of test reports.

Magnetic Particle Testing (MT): Conducting MT, selection of techniques, analysis of indications, and documentation of results.

Radiographic Testing (RT): Presentation and interpretation of radiographic images of welded joints; identification of typical weld discontinuities.

Ultrasonic Testing (UT): Thickness measurements using ultrasonic thickness gauges. Use of ultrasonic flaw detectors and reference blocks (e.g., V1/V2 calibration blocks). Detection and evaluation of signals from artificial reflectors and real discontinuities in welded samples.

Testing of Anti-Corrosion Coatings: Assessment of protective coating condition, measurement of coating thickness, identification of defects and discontinuities.

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<tr><td>Prerequisites and co-requisites</td><td>Successful completion of fundamental undergraduate engineering courses offered by the Faculty of Civil Engineering.

Basic knowledge of the design, fabrication, and performance requirements of metal building structures.

Understanding of welding technologies and processes commonly applied in the construction industry.</td></tr>
<tr><td>Assessment methods and criteria</td><td><table><tr><th>Subject passing criteria</th><th>Passing threshold</th><th>Percentage of the final grade</th></tr><tr><td>test</td><td>60.0%</td><td>100.0%</td></tr></table></td></tr>
<tr><td>Recommended reading</td><td><table><tr><td>Basic literature</td><td>1. PN-90/B-03200. Konstrukcje stalowe. Obliczenia statyczne i projektowanie.
2. PN-B-06200:2002 Konstrukcje stalowe budowlane. Warunki wykonania i odbioru. Wymagania podstawowe
3. PN-EN 1993-1-1 Projektowanie konstrukcji stalowych. Cz. 1.1. Reguły ogólne dla budynków
4. PN-EN 1090-1/-2/-3 Wykonanie konstrukcji stalowych i aluminiowych Cz. 1 Zasady oceny zgodności elementów konstrukcyjnych, Cz. 2. Wymagania techniczne dotyczące wykonania konstrukcji stalowych, Cz. 3. Wymagania techniczne dotyczące wykonania konstrukcji aluminiowych.
5. Lewińska-Romicka A.: Badania nieniszczące. Podstawy defektoskopii. Wydawnictwa Naukowo-Techniczne, Warszawa 2001.
6. Odpowiednie Polskie Normy Polskiego Komitetu Normalizacyjnego w zakresie badań nieniszczących
7. Czuchraj J., Stachurski M.: Badania nieniszczące w spawalnictwie, wyd. IS 2002</td></tr><tr><td>Supplementary literature</td><td>1. Jezierski G: Radiografia Przemysłowa. WNT Warszawa 1993
2. Niedzielski A.: Badania Nieniszczące. Część I. Gdańsk, Wyd. Politechniki Gdańskiej 1991
3. Current versions of legal acts concerning the descriptive part of the building design and the technical specification.
4. Current standards for conducting and classifying metal structures based on nondestructive testing.</td></tr><tr><td>eResources addresses</td><td></td></tr></table></td></tr>
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Example issues/ example questions/ tasks being completed	**1. Theoretical Topics (Sample Exam Questions)** • Explain which standards regulate VT/PT/MT/RT/UT testing of metal structures. • Discuss the formation of welding imperfections and their classification according to PNEN ISO 65201. • List and describe the basic types of discontinuities detectable using the VT method. • Characterize the requirements of the EN 1090 system regarding quality control and NDT procedures. • Present the principles of selecting the scope of NDT during the design and acceptance stages of metal structures. • Explain the differences between destructive and nondestructive testing methods for welded joints. • Describe the principles of penetrant testing and the factors influencing the sensitivity of the method. • Explain the physical foundations of ultrasonic testing in flaw detection (UT). • Describe the imaging principle in radiographic testing and common radiographic errors. • Indicate what information must be included in an Inspection and Test Plan (ITP). **2. Practical (Laboratory) Topics** • Performing dimensional measurements of structural components (e.g., lengths, thicknesses, angles). • Determining weld joint dimensions and joint preparation using weld gauges. • Conducting VT testing identifying and describing discontinuities on welded samples. • Carrying out a complete PT procedure from cleaning to interpretation of indications. • Performing MT testing selection of magnetization technique and analysis of test indications. • Analyzing radiographs identifying discontinuities and evaluating their acceptability according to PNEN ISO 10675. • Measuring thickness using ultrasonic thickness gauges. • Calibrating UT equipment using V1/V2 calibration blocks. • Locating artificial and real discontinuities using an ultrasonic flaw detector. • Measuring protective coating thickness and assessing coating condition. **3. Project / ProblemBased Tasks** • Preparing an Inspection and Test Plan (ITP) for a selected steel structural element (e.g., column, beam, welded joint). • Assessing the conformity of a welded joint based on documentation, VT photographs, and RT images. • Proposing the scope of NDT for a specific structure (e.g., steel hall, pedestrian footbridge). • Selecting an appropriate NDT method for a given material and expected types of discontinuities. • Case study analysis: determining the cause of structural damage/failure and proposing diagnostic methods. • Preparing an NDT report in accordance with PNEN ISO requirements. • Developing a quality control scheme for a structural steel component in class EXC2 or EXC3. **4. Sample Short Control Questions** • What is the minimum inspection area required in VT testing? • What does the term penetrant test sensitivity mean? • Why is calibration of an ultrasonic flaw detector necessary? • What are the limitations of radiographic testing in steel structures? • What is the difference between internal and surface discontinuities? • What types of magnetization are used in MT testing? • What are acceptance levels B and C according to EN ISO 5817?
Practical activites within the subject	Not applicable

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