GDAŃSK UNIVERSITY OF TECHNOLOGY

Subject card

Subject name and code	, PG_00070570		
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	Full-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 dr inż. Aleksander Perliński	

Lesson types

Lesson type	Lecture	Tutorial	Laboratory	Project	Seminar	SUM
Number of study hours	15.0	0.0	0.0	15.0	0.0	30

E-learning hours included: 0.0

eNauczanie source addresses:

Moodle ID: 4339 2025_2026 Utrzymanie i rewaloryzacja konstrukcji metalowych
https://enauczanie.pg.edu.pl/2025/course/view.php?id=4339

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	0.0	0.0	30

Subject objectives

Familiarization with the principles of proper maintenance, repair, and modernization of building structures, particularly those with steel loadbearing frameworks.

Learning outcomes

Course outcome	Subject outcome	Method of verification
[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.	U03: The student is able to clearly and unambiguously present the results of analyses, assessments, and strengthening design projects for steel structures, communicating them both to specialists and to non specialist audiences.	[SK4] Assessment of communication skills, including language correctness
[K6_U05] Conducts research (obtaining information, simulations, experimental methods) in the field of construction in order to solve specific tasks and report research results.	U01: The student is able to assess the technical condition of steel structures using diagnostic methods, data acquisition techniques, analytical and numerical simulations, and is able to formulate technical conclusions. U02:The student is able to design the strengthening of a structural element or an entire steel structure and select appropriate fire protection measures, presenting the results in the form of a technical report.	[SU3] Assessment of ability to use knowledge gained from the subject [SU4] Assessment of ability to use methods and tools [SU2] Assessment of ability to analyse information
[K6_W03] Demonstrate knowledge and understanding of the processes, established standards and design methods in the civil engineering subject area and of their limitations.	W01:The student knows and understands the principles of proper maintenance, diagnostics, repair, and modernization of building structures, particularly steel structures, as well as the limitations of current standards and design methods for existing structures. W02: The student possesses knowledge of degradation processes in steel structures (corrosion, fatigue, fire effects, dynamic influences) and methods of strengthening steel members (modification of the structural system, increasing cross sectional dimensions, reducing slenderness, repairing joints).	[SW1] Assessment of factual knowledge [SW3] Assessment of knowledge contained in written work and projects
[K6_K04] Engages in independent lifelong learning and individually follows the development of science and technology in the field of civil engineering.	K02: The student is capable of independently expanding their knowledge and keeping up with the development of technologies, standards, and modern methods of strengthening and repairing steel structures, treating this as an essential aspect of continuous professional development.	[SK5] Assessment of ability to solve problems that arise in practice
[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.	K01: The student understands the professional and ethical responsibility associated with assessing the technical condition and designing strengthening measures for steel structures, particularly in the context of public safety and the operational durability of buildings.	[SK3] Assessment of ability to organize work [SK5] Assessment of ability to solve problems that arise in practice

Subject contents

Course content – lecture

Metal materials used in historical steel structures: their chemical composition, mechanical properties, and their changes over time. An overview of code revisions related to the design of steel structures. Destructive factors affecting steel structures: vibrations, corrosion, and differential ground settlement. Assessment of the technical condition of structures: diagnostic methods and principles for classifying damage. Examples of damage to steel structures caused by corrosion, high temperatures (fire), design errors, construction errors, and improper operation. Preparatory actions preceding repair and modernization works: documentation, expert assessments, and selection of appropriate technologies. Methods of strengthening steel structures: modification of the structural system, prestressing of elements, increasing crosssectional dimensions of members, and repair or strengthening of structural joints. Protection of structures during repair works: ensuring stability and operational safety. Examples of the revitalization and modernization of steel structures, as well as selected failures of steel structures and methods for their repair.

Course content – project

Strengthening of existing building structures illustrated with the example of a steelsection hall structure, through modification of the structural system, increasing the crosssectional dimensions of members, or altering their slenderness. Analysis and selection of the steel structure and its fire protection measures against the effects of fire action.

Prerequisites and co-requisites

The student:

1. knows the fundamental principles of structural design, particularly for building structures made of steel;
2. is familiar with analytical and numerical methods of structural analysis;
3. is able to determine the values of loads acting on a structural element, a structure, or a building;
4. knows the principles of shaping and connecting steel elements into structural systems and assemblies.

Assessment methods and criteria

Subject passing criteria	Passing threshold	Percentage of the final grade
projects results	60.0%	50.0%
written test	60.0%	50.0%

Recommended reading

Basic literature

1. J. Ziółko Utrzymanie i modernizacja konstrukcji stalowych Wydawnictwo Arkady, Warszawa 1991
2. J. Bródka Przebudowa i utrzymanie konstrukcji stalowych Wydawnictwo Politechniki Łódzkiej, Łódź 1995
3. Masłowski E., Spiżewska D.: Wzmacnianie konstrukcji budowlanych", Wydawnictwo Arkady, Warszawa 2000
4. K. Czapliński Dawne wyroby ze stopów żelaza, DWE, Wrocław 2009 5.
5. T. Urban Rewitalizacja XIX-wiecznych obiektów pofabrycznych, Przegląd budowlany, 2/2012, str. 52-60.
6. J. Tajchman Metoda konserwacji i restauracji dziedzictwa architektonicznego w zakresie zabytkowych budowli, (manuskrypt), Toruń 2009, s. 67

Supplementary literature

1. M. Łubiński, A. Filipowicz, W. Żółtowski Konstrukcje metalowe. Część I Wydawnictwo Arkady, Warszawa 2007
2. K. Rykaluk Konstrukcje stalowe. Podstawy i elementy DWE, Wrocław 2001
3. PN-90/B-03200. Konstrukcje stalowe. Obliczenia statyczne i projektowanie.
4. PN-B-06200:2002 Konstrukcje stalowe budowlane. Warunki wykonania i odbioru. Wymagania podstawowe
5. PN-EN 1993-1-1 Projektowanie konstrukcji stalowych. Cz. 1.1. Reguły ogólne dla budynków
6. 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
7. Odpowiednie Polskie Normy Polskiego Komitetu Normalizacyjnego w odpowiednim zakresie
8. Education aids by ESDEP(European Steel Design Education Programme)
9. Agocs Z., Ziółko J., Vican J., Brodniansky J.: "Assessment and Refurbishment of Steel Structures", London, New York, Bratislava 2005
10. Miesięcznik "Inżynieria i Budownictwo" (zeszyty z ostatnich 10 lat)
11. Miesięcznik "Stahlbau" (zeszyty z ostatnich 10 lat)

eResources addresses

Example issues/ example questions/ tasks being completed	1. Discuss the basic methods of strengthening existing steel structures. 2. Explain how a modification of the structural system can influence the loadbearing capacity of a structure. 3. Define the slenderness of a steel member and discuss its significance for structural stability. 4. List the advantages and disadvantages of strengthening steel members by increasing their crosssectional area. 5. Describe the hazards to steel structures resulting from fire exposure. 6. Discuss the fundamental design strategies for fire protection systems in steel structures. 7. Identify the criteria for assessing the technical condition of existing steel members prior to strengthening. 8. Present the differences between strengthening by welded cover plates and strengthening by adding additional loadbearing elements. 9. Why is it necessary to strengthen structures? 10. How can steel beams, steel columns, steel trusses, or support joints be strengthened? 11. How can a structure be protected against the effects of fire? 12. How should the condition of a structure be assessed? 13. Design a strengthening solution for a steel structure. 14. Design the fire protection system for a steel structure.
Practical activites within the subject	Not applicable

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