GDAŃSK UNIVERSITY OF TECHNOLOGY

Subject card

Subject name and code	, PG_00072920		
Field of study	Civil Engineering		
Date of commencement of studies	October 2026	Academic year of realisation of subject	2026/2027
Education level	second-cycle studies	Subject group	
Mode of study	Full-time studies	Mode of delivery	at the university
Year of study	1	Language of instruction	Polish
Semester of study	1	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. Anna Kopańska	
	Teachers	prof. dr hab. inż. Krystyna Nagrodzka-Godycka dr inż. Paweł Piotrkowski	

Lesson types

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

E-learning hours included: 0.0

eNauczanie source address: https://enauczanie.pg.edu.pl/2025/course/view.php?id=8417

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 student is capable of designing a reinforced concrete frame arch and a ground-supported rectangular liquid storage tank, and has become familiar with the design of reinforced concrete deep beams.

Learning outcomes

Course outcome	Subject outcome	Method of verification
[K7_U03] uses, to a deeper extent, appropriately selected analytical, numerical and experimental tools and methods to carry out tasks in the construction industry	The student interprets the results of calculations and numerical analyses, assessing their correctness and engineering significance.	[SU4] Assessment of ability to use methods and tools
[K7_U02] interprets, in an in-depth way, phenomena and relationships between processes in the construction industry, using modern knowledge in line with the main trends in the development of scientific disciplines related to the field of study	The student demonstrates an advanced understanding of the behaviour of reinforced concrete structures and the interrelationships between geometry, loading conditions, stress distribution, and the load-bearing capacity of structural elements.	[SU3] Assessment of ability to use knowledge gained from the subject
[K7_W04] analyses in-depth complex problems on the basis of reliable data and appropriately chosen methods, reaching logical conclusions	The student is able to design reinforced concrete arch structures and rectangular liquid-retaining tanks in accordance with applicable standards, taking into account the requirements for structural safety, serviceability, and durability.	[SW3] Assessment of knowledge contained in written work and projects
[K7_W01] identifies in-depth the phenomena related to the field of study and the theories describing them, indicating reliable sources of knowledge and information relevant to the issues analysed	The student interprets the results of numerical analyses of arch structures and liquid-retaining tanks, relating them to the actual structural behaviour and load-transfer mechanisms of the system.	[SW3] Assessment of knowledge contained in written work and projects

Subject contents

Course content – laboratory

Modelling of Reinforced Concrete Structures in the RFEM (Dlubal) Environment. Creation of computational models of reinforced concrete frame arches and rectangular liquid-retaining tanks. Definition of structural geometry, material properties, support conditions, and structural systems. Application of load cases in accordance with relevant design standards, including permanent loads, imposed loads, snow loads, wind loads, and hydrostatic liquid pressure. Formation of load combinations and evaluation of their influence on structural behaviour. Static analysis and determination of internal forces in reinforced concrete frame arches. Assessment of the effects of structural geometry, support conditions, and loading arrangements on the distribution of bending moments, axial forces, and displacements. Modelling of tie elements in arch structures and investigation of the influence of their stiffness, cross-sectional properties, and prestressing force on structural performance. Evaluation of the effects of tie parameters on the reduction of bending moments, modification of internal force distributions, and overall efficiency of arch action. Modelling of rectangular reinforced concrete liquid-retaining tanks using surface elements. Analysis of wall and base slab behaviour under hydrostatic pressure, including identification of regions of maximum stresses and displacements. Verification of computational models and comparison of numerical results with analytical solutions.

Course content – project

Discussion of the principles for determining loads acting on arch structures, including permanent loads, imposed loads, snow loads, and wind loads, in accordance with relevant design standards. Discussion of the design principles for reinforced concrete arches subjected to eccentric compression. Analysis of the influence of arch geometry, member slenderness, and load eccentricity on the distribution of internal forces and stress states. Presentation of methods for accounting for second-order effects and procedures for stability assessment, including buckling phenomena. Discussion of the detailing and design of reinforcement in reinforced concrete arches in accordance with ultimate and serviceability limit state requirements. Presentation of issues related to the design and analysis of rectangular reinforced concrete liquid-retaining tanks. Discussion of the determination of hydrostatic pressure loads and their effects on the behaviour of walls, base slabs, and stiffening elements. Presentation of procedures for verifying the load-bearing capacity and serviceability performance of liquid-retaining structures. Discussion of the design principles for reinforced concrete deep beams. Presentation of methods for determining internal forces and stress distributions in deep beams.

Prerequisites and co-requisites

The student is able to design reinforced concrete members subjected to eccentric compression, as well as structural elements subjected to biaxial bending.

Assessment methods and criteria

Subject passing criteria	Passing threshold	Percentage of the final grade
laboratory	50.0%	50.0%
project	50.0%	50.0%

Recommended reading

Basic literature

W. Starosolski, Konstrukcje żelbetowe według Eurokodu 2 i norm związanych, t. 5 PWN, Warszawa 2024.

W. Starosolski, Konstrukcje żelbetowe według Eurokodu 2 i norm związanych, t.4 PWN, Warszawa 2026.

A. Halicka, D. Franczak, Projektowanie zbiorników żelbetowych, t.2, Wydawnictwo Naukowe PWN, Warszawa 2013.

M. Knauff, Obliczanie Konstrukcji Żelbetowych według Eurokodu 2, Wydanie III poszerzone, PWN 2.

J.Kobiak, W.Stachurski, Konstrukcje żelbetowe, t.3, Arkady, Warszawa 1989.

J.Kobiak, W.Stachurski, Konstrukcje żelbetowe, t.4, Arkady, Warszawa 1991.

	Supplementary literature	Sekcja Konstrukcji Betonowych KILiW PAN, Podstawy projektowania konstrukcji żelbetowych i sprężonych według Eurokodu 2, DWE, Wrocław, 2006. T. Godycki-Ćwirko, Mechanika Betonu, Arkady, Warszawa, 1982. F. Leonhardt - R. Walther: Leonhardt F, Walther R. Wandartige Träger. Deutscher Ausschuss für Stahlbeton, nr 178 F. Leonhardt, E. Mönnig Vorlesungen über Massivbau. Zweiter Teil und Dritter Teil, Springer-Verlag, Berlin.
	eResources addresses	
Example issues/ example questions/ tasks being completed		
Practical activites within the subject	Not applicable	

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