GDAŃSK UNIVERSITY OF TECHNOLOGY

Subject card

Subject name and code	Bridge structures, PG_00041518		
Field of study	Civil Engineering		
Date of commencement of studies	October 2022	Academic year of realisation of subject	2022/2023
Education level	second-cycle studies	Subject group	Optional 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	2	ECTS credits	3.0
Learning profile	general academic profile	Assessment form	assessment
Conducting unit	Department of Railway Engineering -> Faculty of Civil and Environmental Engineering		
Name and surname of lecturer (lecturers)	Subject supervisor	dr hab. inż. Marcin Abramski	
	Teachers		

Lesson types and methods of instruction

Lesson type	Lecture	Tutorial	Laboratory	Project	Seminar	SUM
Number of study hours	30.0	0.0	0.0	15.0	0.0	45

E-learning hours included: 0.0

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	25.0	75

Subject objectives

Basic knowledge on bridge structures made of steel and/or concrete. Static systems, design of structure, equipment and maintenance of bridges. Project of simply supported reinforced concrete bridge in grid static system.

Learning outcomes

Course outcome	Subject outcome	Method of verification
[K7_W02] knows principles of analysis, design and dimensioning of complex constructions and its elements	After passing the course students should be able to: • define basic terms concerning the bridge structures, • name and determine types of bridges, • recognize structural members of bridge structures and explain system of carrying the loads by them, • name bridge equipment elements and explain their role, • draw sample cross-sections and longitudinal sections of plate, beam, frame, arch, cable-stayed and suspension bridges.	[SW1] Assessment of factual knowledge [SW2] Assessment of knowledge contained in presentation
[K7_U02] can design and dimension complex steel, concrete (including reinforced), wood and masonry construtions and its details	After passing the course students should be able to do the following for a single-span reinforced concrete grid bridge structure: • calculate bending moments and shear forces for any given longitudinal girder, • present principles of design, i.e. detailing and dimensioning of the individual structural members, • draw detailed cross-section and longitudinal section of the structure, including bridge equipment.	[SU1] Assessment of task fulfilment [SU5] Assessment of ability to present the results of task

Subject contents	**LECTURES** 1. Prestressed concrete. Pre-tensioned and post-tensioned concrete structures. Bonded and unbonded post-tensioning. Structure safety in design process: full, reduced and partial prestressing. Prestressing tendons: wires, strands and cables. Dead-end and live-end anchorages of strands and cables. Modes of failure for prestressed concrete structures. 2. Bridge supports. Abutment: its parts and their role in carrying the loads. Soil lateral pressure on abutments. Approach slabs in abutments. Global stability of abutments and piers. Geosynthetic Reinforced Soil bridge abutments. River piers, ice aprons. Scour in river piers. Seismic hazards for bridge supports. 3. Classification of bridges with regard to structure type of main girders: beam bridges, truss bridges, frame bridges, arch bridges, cable-stayed bridges, suspension bridges, extradosed bridges, stressed ribbon bridges. 4. Short- and medium-span concrete beam bridges. Static schemes. Span cross-sections (including slab bridges). Using prefabricated concrete beams in bridge construction. Methods of making freely supported bridge spans fully or partially continuous. Bituminous expansion joints. 5. Other types of concrete bridges: frame bridges, arch bridges, cable-stayed bridges, extradosed bridges, stressed ribbon bridges. 6. Contemporary technics of concrete bridge construction: fully cast on falsework, with prefabricated structural members, incremental launching, balanced-cantilever method. 7. Exploitation and maintenance of bridges. Bridge damages, bridge inspections. Rehabilitation and strengthening methods. 8. Elements of bridge equipment. Expansion joints (types and choice principles), bearings, drainage, barriers, railings, acoustic barriers. 9. Traffic loads on bridges. 10. Steel bridges - construction and design (beam bridges, truss bridges, arch bridges). 11. Bridge testing (load tests, measurement techniques). 12. Fatigue life of bridges. **PROJECT** Single-span reinforced concrete road bridge in static system of grid. 1. Draft project (drawings). 2. Static calculation: a) influence line (rigid cross-beam method), b) determining of loads according to Eurocode 1, c) determining of loads related to individual girder, d) determining of internal forces (bending moment, shearing force) considering six cross-sections situated every L/10 in length. 3. Design of a a given girder in Ultimate Limit State: a) bending, b) shearing. 4. Drawings. a) general drawing of bridge b) structure of main girder
Prerequisites and co-requisites	Structural statics: statically determinant structures Concrete structures: designing reinforced concrete beam members subjected to bending moments and shearing forces

Assessment methods and criteria

Subject passing criteria	Passing threshold	Percentage of the final grade
Presentation	60.0%	10.0%
Project defence in written form	60.0%	25.0%
Project	60.0%	25.0%
Test on lectures	60.0%	40.0%

Recommended reading

Basic literature	Zhao J.J., Tonias D.E.: Bridge Engineering: Design, Rehabilitation, and Maintenance of Modern Highway Bridges. Publisher: McGraw- Hill Education, 3rd ed.: 2012.
Supplementary literature	Calgaro J.-A., Tschumi M., Gulvanessian H.: Designer's Guide to Eurocode 1: Actions on bridges. Thomas Telford Ltd. London, 2010.

	eResources addresses	Adresy na platformie eNauczanie: Bridge structures - 2022/2023 - Moodle ID: 24011 https://enauczanie.pg.edu.pl/moodle/course/view.php?id=24011
Example issues/ example questions/ tasks being completed		
Work placement	Not applicable	