



## Subject card

Subject name and code	Steel and composite bridge structures, PG_00045875						
Field of study	Civil Engineering						
Date of commencement of studies	February 2023	Academic year of realisation of subject			2023/2024		
Education level	second-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	1	Language of instruction			Polish		
Semester of study	2	ECTS credits			5.0		
Learning profile	general academic profile	Assessment form			exam		
Conducting unit	Department of Railway Engineering -> Faculty of Civil and Environmental Engineering						
Name and surname of lecturer (lecturers)	Subject supervisor	dr hab. inż. Krzysztof Żółtowski					
	Teachers	dr hab. inż. Krzysztof Żółtowski dr inż. Marek Szafranski					
Lesson types and methods of instruction	Lesson type	Lecture	Tutorial	Laboratory	Project	Seminar	SUM
	Number of study hours	30.0	15.0	0.0	15.0	0.0	60
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	60	10.0		55.0		125
Subject objectives	To get a basic knowledge of design of metal and composite bridge structures. A simplified mechanical models and reality. Basic issues of construction and design.						
Learning outcomes	Course outcome	Subject outcome			Method of verification		
	[K7_W15] has deep and adequate knowledge of civil engineering, within offered specialization and profile	Has knowledge of steel and composite bridges, in particular: a) types and properties of structural materials; b) types of structural systems (statics, design, construction); c) analysis and design of structural elements due to standards design and FEM calculations.			[SW1] Assessment of factual knowledge		
	[K7_W02] knows principles of analysis, design and dimensioning of complex constructions and its elements	Can: a) identify static and constructional problems related to the designed structural system; b) select methods and tools for static analysis and design of a given structural system.			[SW1] Assessment of factual knowledge [SW3] Assessment of knowledge contained in written work and projects		
[K7_U02] can design and dimension complex steel, concrete (including reinforced), wood and masonry constructions and its details	Can: a) identify computational problems related to the designed structural system; b) select methods and tools for static analysis and design of a given structural system; c) adopt design solutions in accordance with the constructional principles of steel and composite spans.			[SU1] Assessment of task fulfilment [SU4] Assessment of ability to use methods and tools [SU3] Assessment of ability to use knowledge gained from the subject			

Subject contents	<p>LECTURES</p> <ol style="list-style-type: none"> <li>Theory and real construction. The actual work of steel bridge elements (nodes, connections, bracing).</li> <li>Complex bridges (steel - concrete). Shear connectors flex, rigid - with applications. Technologies perform concrete slabs. Prestressed Composite. Steel lattice structures with concrete deck. Rheology technical approach.</li> <li>Steel girders - large spans with constant and variable height, sections open, closed one and hollow.</li> <li>Lattice bridges - large spans. Principles of constructing of main girders: lattice with parallel flanges and with variable height. Recent types of trusses - calculation. Bridges without bracings in upper flange stability issues of compressed flange. The distributions of stresses in gusset plates. Portal frames and the types of concentrations.</li> <li>Bridge bearings.</li> <li>Arched bridges. Types of arch bridges: Langer type bridges, arches combined with the stiffness of the roadway. Location of roadway: top, bottom, middle position and stability issue associated with it. Large and small span in arches - differences. Bracing of arches: portal frames inclined, horizontal, type Vierendeel solution. Bracing and the related problems of the theory of second order. Arched truss bridges.</li> <li>Suspended and cable stayed bridges. Types of bridge systems, geometry of cables, stays, pylons and roadway. Specificity of the construction of the road way. The construction of cables and hangers. Spans - cross sections open and hollow – wind action. Bearing for large suspension bridges. The specificity of assembly. Hanging footbridge. Dynamics and aerodynamics - selected issues. Overview of cable stayed and hanging bridges.</li> <li>Swing bridges - review.</li> </ol> <p>PRACTICAL CLASSES</p> <p>A design study of the truss railway bridge (welded, single-span, single-track)</p> <ol style="list-style-type: none"> <li>Construction of the span - structural and non-structural elements (equipment).</li> <li>Static schemes of the girders.</li> <li>Geometry of truss bridges - lattice types, girder's shape, decks.</li> <li>Cross-section of structural elements - girder elements, deck elements, bracings.</li> <li>Static analysis - spatial FEM model; loads and it's combinations; influence lines, inner forces (normal forces, bending moments).</li> <li>Designing of elements - ultimate limit state, fatigue, serviceability limit state.</li> <li>Designing of construction joints.</li> <li>Designing of truss girders - general requirements.</li> <li>Structural drawings.</li> </ol>											
Prerequisites and co-requisites	Structural Mechanics, Strength of Materials. The theory of design of steel and reinforced concrete											
Assessment methods and criteria	<table border="1"> <thead> <tr> <th data-bbox="451 1010 794 1048">Subject passing criteria</th> <th data-bbox="794 1010 1137 1048">Passing threshold</th> <th data-bbox="1137 1010 1487 1048">Percentage of the final grade</th> </tr> </thead> <tbody> <tr> <td data-bbox="451 1048 794 1077">design work</td> <td data-bbox="794 1048 1137 1077">70.0%</td> <td data-bbox="1137 1048 1487 1077">50.0%</td> </tr> <tr> <td data-bbox="451 1077 794 1115">written exam</td> <td data-bbox="794 1077 1137 1115">60.0%</td> <td data-bbox="1137 1077 1487 1115">50.0%</td> </tr> </tbody> </table>			Subject passing criteria	Passing threshold	Percentage of the final grade	design work	70.0%	50.0%	written exam	60.0%	50.0%
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design work	70.0%	50.0%										
written exam	60.0%	50.0%										
Recommended reading	Basic literature	<ol style="list-style-type: none"> <li>Czudek H., Radomski W.: <i>Podstawy mostownictwa</i>. PWN, Warszawa 1983.</li> <li>Leonhardt F.: <i>Budowa mostów</i>. WKiŁ, Warszawa 1982.</li> <li>Madał A., Wołowicki W.: <i>Budowa i utrzymanie mostów</i>. WKiŁ, Warszawa 1995.</li> <li>Furtak K., Mosty zespolone, PWN, Warszawa, Kraków, 1999</li> <li>Hydzik J.: „<i>Mosty kolejowe</i>”, WKŁ, Warszawa, 1986.</li> <li>Ryżyński A., Wołowicki W., Skarżewski J., Karlikowski J.: „<i>Mosty stalowe</i>”, PWN, Warszawa – Poznań, 1984.</li> <li>Danielski L.: „<i>Mosty metalowe</i>”, Politechnika Wroclawska, Wrocław, 1983.</li> <li>Biliszczuk J., Mosty podwieszane. ARKADY, Warszawa, 2005</li> </ol>										
	Supplementary literature	<ol style="list-style-type: none"> <li>Cholewo J., Sznurowski M.: „<i>Mosty kolejowe i fundamentowanie</i>” ,WKŁ, Warszawa, 1965.</li> <li>Korelewski J.: „<i>Mosty stalowe</i>”, Politechnika Krakowska, Kraków, 1980.</li> <li>Szelągowski F.: „<i>Mosty metalowe</i>”, WKŁ, Warszawa, 1966.</li> <li>Pszenicki A.: „<i>Mosty stalowe nitowane</i>”, Wydawnictwa Komunikacyjne, Warszawa, 1954.</li> <li>Furtak K., Mosty zespolone, PWN, Warszawa, Kraków, 1999</li> <li>Jarominia A.; <i>Mosty podwieszane</i>. Oficyna Wydawnicza Politechniki Rzeszowskiej, Rzeszów 1997.</li> <li>Karlikowski J., Sturzbecher K.: „<i>Mosty stalowe. Mosty belkowe i zespolone. Przewodnik do ćwiczeń projektowych</i>” Politechnika Poznańska, Poznań, 2003.</li> <li>Malinowski M., Miśkiewicz M., Szafranski M.: „<i>Materiały pomocnicze do projektowania mostów metalowych</i> – wersja elektroniczna na stronie internetowej <a href="http://www.okno.pg.gda.pl">http://www.okno.pg.gda.pl</a>.</li> </ol>										
	eResources addresses	<p>Adresy na platformie eNauczanie:</p> <p>Mostowe Konstrukcje Stalowe i Zespolone - 2023/24 - Moodle ID: 30789</p> <p><a href="https://enauzanie.pg.edu.pl/moodle/course/view.php?id=30789">https://enauzanie.pg.edu.pl/moodle/course/view.php?id=30789</a></p>										
Example issues/ example questions/ tasks being completed	Static analysis and dimensioning of bridge structures											
Work placement	Not applicable											