Annex No. 9
to the Rector's Decision No. 35/19
as amended by Decision No. 12/22

COURSE SPECIFICATION

Course code	full-time:	**B1-5-505**
	part-time:	**BN1-5-504**
Course title in Polish	**Konstrukcje metalowe 1**	
Course title in English	**Metal Structures 1**	
Valid from academic year	**2023/2024**	

CURRICULAR ALIGNMENT

Programme	**CIVIL ENGINEERING**
Level	**first-cycle**
Programme profile	**academic**
Mode of attendance	**full-time; part-time**
Specialism	**all**
Academic unit responsible for the course	**Department of Strength of Materials and Building Structures**
Course coordinator	**dr hab. inż. Andrzej Szychowski, prof. PŚk**
Approved by	**prof. dr hab. inż. Grzegorz Świt**

COURSE DESCRIPTION

Teaching block		**major**
Course status		**required**
Language of instruction		**Polish**
Semester of delivery	full-time	**semester V**
	part-time	**semester V**
Prerequisites		**Strength of Materials 1, 2; General Construction; Actions on Building Structures; Structural Mechanics 1**
Exam (YES/NO)		**NO**
ECTS		**4**

Mode of teaching		**lecture**	**class**	**lab**	**project**	**other**
Number of hours per semester	full-time:	**30**	**15**	**15**	**15**	
	part-time:	**24**	**12**	**12**	**12**	

LEARNING OUTCOMES

Category	Code	Learning outcomes	Corresponding programme outcome code
Knowledge	W01	Students know how to determine the grade and resistance of a steel section in simple and interacting load conditions.	B1_W08 B1_W09
	W02	Students have knowledge of determining the resistance of bar members with loss of stability taken into account.	B1_W07 B1_W09
	W03	Students know how to design welded and bolted joints.	B1_W08 B1_W09
Skills	U01	Students can determine the resistance of a steel section depending on its class/grade and mode of loading.	B1_U02 B1_U14
	U02	Students are able to design compression, transverse bending and simultaneous compression and bending elements taking into account different forms of stability loss.	B1_U10 B1_U13 B1_U14
	U03	Students can design shop welded connections and bolted assembly connections of metal structure elements.	B1_U13 B1_U14
Competence	K01	Students are able to work individually.	B1_K01
	K02	Students understand the importance of responsibility in engineering activities.	B1_K02
	K03	Students formulate conclusions from the tasks performed and are responsible for the reliability of the results obtained.	B1_K04

COURSE CONTENT

Teaching mode*	Topics covered
lecture	Advantages and disadvantages of steel as a structural material, mechanical properties, production methods, examples of steel used in building structures, and steel bar-type structures.
	Range of steel sections, hot-rolled, welded and cold-formed sections, geometric and strength characteristics of sections used.
	Fundamentals of forming and calculation of welded and bolted connections.
	Section class of a bar element, the behaviour of the section depending on its class under different loading states.
	Dimensioning of elements in axial tension, section weakening.
	Bearing capacity of steel sections in compression, bending and shear depending on its class. Plastic, elastic, critical and supercritical bearing capacity. Bearing capacity reduction in the section under complex loads.
	Dimensioning of compression members, buckling, critical length, effect of imperfection, buckling coefficient, fundamentals of calculation of members in compression according to the 2nd order theory, structural issues in column design.
	Dimensioning of flexural beams, ways of securing the beam against torsion, the phenomenon of lateral torsion, critical moment for different cases of support and loading of the beam, the effect of imperfection, the coefficient of lateral torsion, structural issues in the design of beams.
	Introduction to the design of plate girders, section shaping, local and general loss of stability, resistance to concentrated loads, stiffening rib design.

	Design of members subjected to simultaneous compression and bending, amplification of displacements and cross-sectional forces, dimensioning of compression and bending elements taking into account the coefficients of general instability and interaction coefficients, fundamentals of compression and bending elements calculation according to the second-order theory.
class	Joints in metal structures.
	Construction and dimensioning of butt and fillet welds. Examples of calculation and design of shop welded joints.
	Formation and calculation of bolted connections. Examples of calculation and design of assembly connections.
	Non pre-loaded and pre-loaded slip-resistant lap joints.
	Non pre-loaded and pre-loaded butt joints.
lab	Occupational Health and Safety Training.
	Estimation of steel mechanical properties based on hardness test.
	Measurement of random geometry of steel sections, comparison of random dimensions with nominal ones, tolerances of geometric dimensions.
	Comparison of stiffness of flexural beams made of different metal materials (steel, aluminium, brass).
	Elastic buckling of a compression member, experimental determination of the critical force.
	Elastic lateral buckling, experimental determination of the critical moment of a single-span transverse beam in bending.
	Bearing capacity of a bolted lap joint, experimental determination of the ultimate load and failure mechanism of a bolted flat bar joint.
	Bearing capacity of a bolted butt joint, geometric inventory of existing joint, estimation of the design bearing capacity.
project	Design of the steel supporting structure of the roof on a single-story building. Statement and assembly drawing of the structure. Dimensioning of structural elements: floor beam, binding joist, and column. Design of a steel joist to column assembly. Detailed drawings of calculated elements.

METHODS OF LEARNING OUTCOMES VERIFICATION

Learning outcome	Verification methods					
	Oral exam	Written exam	Test	Project	Report	Other
W01			X	X		
W02			X	X	X	
W03			X	X	X	
U01			X	X		
U02			X	X	X	
U03			X	X	X	
K01			X	X		
K02			X	X	X	
K03			X	X	X	

ASSESSMENT

Teaching mode*	Assessment type	Criteria
lecture	mark-based	*Scoring at least 50% on the written test*
class	mark-based	*At least a passing grade on each in-class assignment.*
lab	mark-based	*At least a passing grade on each report.*
project	mark-based	*Attaining at least a passing grade on each project assignment and at least a passing grade on its written defence.*

STUDENT WORKLOAD

ECTS weighting												
	Activities	Student workload										
		full-time					part-time					
1.	Scheduled contact hours	W	C	L	P	S	W	C	L	P	S	h
		30	15	15	15		24	12	12	12		
2.	Other (office hours, exams)	2	2	2	2		2	2	2	2		h
3.	**Total number of contact hours**	**83**					**68**					h
4.	**Number of ECTS credits for contact hours**	**3,3**					**2,7**					ECTS
5.	**Independent study hours**	**17**					**32**					h
6.	**Number of ECTS credits for independent study**	**0,7**					**1,3**					ECTS
7.	**Practical hours**	**60**					**60**					h
8.	**Number of ECTS credits for practical hours**	**2,4**					**2,4**					ECTS
9.	**Total workload**	**100**					**100**					h
10.	**ECTS credits for the course** *1 ECTS credit =25 student learning hours*	**4**										

READING LIST

1. PN-EN 1993-1-1:2006/AC:2009 Eurokod 3: Projektowanie konstrukcji stalowych. Część 1-1: Reguły ogólne i reguły dla budynków.
2. PN-EN 1993-1-5:2008 Eurokod 3: Projektowanie konstrukcji stalowych. Część 1-5: Blachownice.
3. PN-EN 1993-1-8:2006/AC:2009 Eurokod 3: Projektowanie konstrukcji stalowych. Część 1-8: Projektowanie węzłów.
4. Budownictwo ogólne. Tom 5. Stalowe konstrukcje budynków. Projektowanie wg. Eurokodów z przykładami obliczeń. Praca zbiorowa pod kierunkiem M. Giżejowskigo i J. Zółki. Arkady, Warszawa 2010.
5. Rykaluk K.: Konstrukcje metalowe. Część 1. Dolnośląskie Wydawnictwo Edukacyjne, Wrocław 2016.
6. Konstrukcje stalowe. Przykłady obliczeń według PN-EN 1993-1. Część pierwsza. Wybrane elementy i połączenia. Praca zbiorowa pod red. A. Kozłowskiego. Oficyna Wydawnicza Politechniki Rzeszowskiej. Rzeszów 2012.
7. Konstrukcje stalowe. Przykłady obliczeń według PN-EN 1993-1. Część druga. Stropy i pomosty. Praca zbiorowa pod red. A. Kozłowskiego. Oficyna Wydawnicza Politechniki Rzeszowskiej. Rzeszów 2015.
8. Goczek J., Supeł Ł., Gajdzicki M.: Przykłady obliczeń konstrukcji stalowych. Wydawnictwo Politechniki Łódzkiej, Łódź 2011.
9. Trahair N., Bradford M., Nethercot D., Gardner L.: The behaviour and design of steel structures to EC3. Taylor and Francis, London and New York 2008.
10. Łubiński M., Filipowicz A., Żółtowski W.: Konstrukcje Metalowe. Część I. Arkady, Warszawa 2000.