Metal Structures I

Kierunek:

Budownictwo

Karta Opisu Przedmiotu

Name of course						Code of course	Year / Semester	
Metal structures I ***Konstrukcje metalowe I***							**III**	**05**
Type of course		**Profile**				**Level of qualification**		
obligatory		**generally academic**				**Full-time, first degree – S1**		
Rodzaj zajęć							**ECTS**	
Lecture	**Practice**	**Laboratory**	**Design**	**Seminar**	**Exam**			
15	**30**	**-**	**15**	**-**	**NO**		**6**	
Person leading of course::								
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I.CARD OF COURSE	
OBJECTIVE OF THE SUBJECT	
C01	The understanding of the metal (steel) as a construction material and the understanding of the essence of metal structures.
C02	The skill acquisition of the design and calculation of the load capacity of the bending, compression, tension and shear cross-sections of the steel elements according to ULS rules. The skills acquisition of the design and calculation of the welded and bolted connections.
C03	The skill acquisition of the steel elements calculations according to SLS rules.
PREREQUISITES FOR KNOWLEDGE, SKILLS AND OTHER COMPETENCE	
1	The basic knowledge of the civil engineering.
2	The basic knowledge of the theoretical mechanics and the strength of materials and the skill to calculate the sections strength parameters.
3	The knowledge of the structural mechanics and the ability to solve the static equilibrium systems.
4	Ability to use the standards of the construction loads.
5	Ability to use of CAD program.
6	The knowledge of the preparing principles of the technical drawings and the ability to read and apply them.
LEARNING OUTCOMES:	
Knowledge: the graduate knows and understands	
EK1	The graduate knows the behaviour of steel structures. The graduate knows how to solve simple engineering tasks in the field of steel structures.
Skills: the graduate can	
EK2	The graduate can obtain information from the literature and other sources, including the manufacturers catalogues of the steel construction elements. The graduate can choose the specific computational procedures. The graduate can choose the element cross-section and graphically interpret the result. The graduate can specify the output parameters for the simple engineering tasks on the basis of given sketch.
Social competence: The student is ready to	
EK3	The student is ready to work in a group and make his/her own decisions related with design metal structures.

II. CONTENTS OF COURSE	
Form of teaching - Lectures	**Number**

		of hours
W1	The basic issues of the metal structures.	1
W2	The steel production process and the range of the steel products.	1
W3	The load capacity of the tensile elements with aspects of building information modelling.	1
W4	The classification of the cross-sections.	1
W5	The load capacity of the compression elements with aspects of building information modelling.	1
W6	The load capacity of the compression elements (buckling resistance).	1
W7	The load capacity of the bending elements with aspects of building information modelling.	1
W8	The load capacity of the bending elements (buckling resistance).	1
W9	The load capacity of the shear elements.	1
W10	The load capacity of the bolted connections.	1
W11	The load capacity of the bolted connections.	1
W12	The load capacity of the welded connections.	1
W13	The rules of the steel structures drawings.	1
W14	The rules of the steel structures drawings.	1
W15	Final test.	1
	TOTAL:	**15**

Form of teaching – Practice		**Number of hours**
Cw1	The organizational classes and acquainted with the standards: PN-EN-1993-1 part 1, 5 and 8.	2
Cw2	The calculations of load capacity of the tensile elements.	2
Cw3	The calculations of load capacity of the tensile elements.	2
Cw4	The calculations of the cross-sections class.	2
Cw5	The calculations of load capacity of the compression elements.	2
Cw6	The calculations of load capacity of the compression elements.	2
Cw7	The calculations of load capacity of the bending elements.	2
Cw8	The calculations of load capacity of the bending elements.	2
Cw9	The calculations of load capacity of the shear elements.	2
Cw10	The calculations of load capacity of the bending and shear elements.	2
Cw11	The calculations of load capacity of the bolted connections.	2
Cw12	The calculations of load capacity of the bolted connections.	2
Cw13	The calculations of load capacity of the welded connections.	2
Cw14	The calculations of load capacity of the welded connections.	2
Cw15	Final test.	2
	TOTAL:	**30**

Form of teaching – Design		**Number of hours**
Pr1	The assumptions of projects.	1
Pr2	Loads.	3
Pr3	The design of the web (shear element).	1
Pr4	The design of the flanges (bending elements).	3
Pr5	The design of connection of the secondary beam with the main beam.	1
Pr6	The design of assembly connections of the main beams.	2
Pr7	The design of the welded connections.	1
Pr8	The steel structures drawings.	3
	TOTAL:	**15**

TOOLS OF TEACHING	
1.	The lecture carried out with the using of audio-visual means.
2.	The exercises carried out with the using of audio-visual means, board and chalk.

3.	The materials prepared by the teachers.
4.	Literature.

METHODS OF ASSESSMENT: (F - FORMATIVE; P - SUMMARY)	
F01	The assessment of the individual preparation for the exercises.
P01	The assessment of the knowledge and skills to apply computational procedures according to ULS.
P02	The assessment of the knowledge and skills to apply computational procedures according to SLS.
P03	The assessment of the familiarize with the knowledge in the context of the calculation procedures.

III.WORKLOAD OF STUDENT

O.n.	**Activity**	**Average number of hours/ECTS to complete the activity [hours]**
1. Contact hours with the teacher:		
1.1	Hours of classes organized by the universities – **lecture**	15
1.2	Hours of classes organized by the universities – **practice**	30
1.3	Hours of classes organized by the universities – **laboratory**	0
1.4	Hours of classes organized by the universities – **design**	15
1.5	Consultations	15
1.6	Exam	0
	Total contact hours with the teacher:	**75**
2. Student's own work		
2.1	Preparing for the practices and for the final test	20
2.2	Preparation for the laboratory, execution of individual test reports	0
2.3	Preparing own project	15
2.4	Preparation for the final test from the lecture	5
2.5	Preparation for the exam	0
2.6	Get acquainted with the indicated literature	5
	Total hours of student work:	**45**
	General workload of the student:	**120**
TOTAL NUMBER OF ECTS FOR SUBJECT:		
The number of **ECTS** which the student receives in a course requiring direct teacher involvement:		**4.5**
The number of **ECTS** which the student receives in a practical course, including laboratory and project classes:		**1.5**

BASIC AND ADDITIONAL LITERATURE

Basic literaturę:

1.	Bogucki W.: Tablice do projektowania konstrukcji metalowych. Arkady. Warszawa 1996.
2.	ECCS - European Convention for Constructional Steelwork, Design of Steel Structures: Eurocode 3 - Design of Steel Structures. Part 1-1 - General Rules and Rules for Buildings. John Wiley & Sons, Berlin 2014.
3.	Ghosh K. M.: Practical Design of Steel Structures. Whittles Publishing, Dunbeath, Caithness KW6 6EY, Scotland, UK 2010.
4.	Hancock G., Wilkinson T.J., Zhao X.L., Cold-formed Tubular Members and Connections: Structural Behaviour and Design. Elsevier B.V., Great Britain 2005.
5.	Knowles P.R., Design of Structural Steelwork. CRC Press, London 2005.
6.	Negi L.S., Design of Steel Structures 2 Edition. Tata McGraw-Hill Publishing Company Limited, New Delhi 1997.
7.	PN-EN 1993-1-1 Eurocode 3: Design of steel structures. Part 1-1: General rules and rules for

	buildings.
8.	PN-EN 1993-1-5 Eurocode 3 : Design of steel structures. Part 1-5 : Plated structural elements.
9.	PN-EN 1993-1-8 Eurocode 3 : Design of steel structures. Part 1.8 : Design of joints.
Additional literature:	
1.	Segui W., Steel Design. Cengage Learning, Stamford 2012

V.MATRIX OF IMPLEMENTATION EFFECTS OF EDUCATION FOR DIRECTION

The effect of learning	The reference to the effect of learning defined for the entire program	Reference of the effect to characteristics of I and II PRK		Objectives of the course	Program content	Tools of teaching	Method for assessing
		universal	In technical sciences and leading to engineering competencies				
EK1	K1_W08 K1_W10	P6U_W	P6S_WG	C01 C02 C03	W1-W12 C1-C14	1, 2, 3, 4	F01, P03
EK2	K1_U05 K1_U16	P6U_U	P6S_UW	C01 C02 C03	W1-W14 C2-C14	1, 2, 3, 4	F01, P01, P03, P03
EK3	K1_K01 K1_K02 K1_K03	P6U_K	P6S_KK	C01 C02 C03	W1 W14 C1-C14	1, 2, 3, 4	P03

VI.METHODS ASSESSMENT - DETAILS

MARKS	LEARNING OUTCOME
	EK1
2,0	The student knows only the basic terms relating to the steel. Student knows briefly the computational models of the steel structures. He cannot determine the factors influencing the loss of stability. He does not know the rules of the section selection. The student does not know the primary literature, which is needed for design.
3,0	The student completed the knowledge of new terminology and symbols of the steel and the general knowledge of the processes and phenomena relevant to the strength of steel. The student can explain in further detail the behaviour of the steel under the load, as the building material. Student knows the computational models, but he has problems with the interpretation them. He can determine the factors influencing the loss of stability. He knows briefly the rules of the section selection. Student knows the computational models. He can determine the factors influencing the loss of stability. The student completed the basic information needed to design, he knows briefly set of standards (EC3 part 1, 5, 8) The student knows the applicable set of standards and he can use them independently of each other (EC3 part 1, 5, 8).
4,0	Moreover, the student can explain in detail the behaviour of the steel under the load, as a building material, the issue of sustainability. The student can explain in further detail the behaviour of some steel elements under the load. Student can interpret the computational models and he can define their application. He knows the rules of the section selection. In addition, the student knows briefly the principles and purposes of calculating the structure according to the ULS and SLS. The student is able to use all standards and connect them throughout the whole design process (EC3 part 1, 5, 8). Moreover, the student is able to analyse the results of calculations during the design process.
5,0	Moreover, the student can explain the behaviour of the steel elements under the load and he can identify the environmental hazards. He knows methods to prevent their effects. Moreover, the student knows in detail the principles and purposes of calculating the structure according to the ULS and SLS, and understands their importance. Moreover, the student completed the information given in the standards of knowledge given in the books.
	EK2

2,0	The student cannot recognize the behaviour of the section or structural element on the basis of the static scheme of the structure. The student is not aware of the calculation procedures. The student cannot do a section sketch of selected item.
3,0	Students can also determine the sequence of calculations. Student is able to interpret the results of calculations. The student is aware of the need to modify the calculation according to the partial results, but he cannot identify the appropriate solution. Moreover, the student is able to identify the right solution. The student is able to perform correctly a section sketch. The student is able to interpret the made sketch.
4,0	Students can also determine the sequence of calculations. Student is able to interpret the results of calculations. The student modifies the calculations based on the partial results, but only in the context of the bases cases. Moreover, the student is able to modify the calculations for the complex cases. The student is able to draw up the sections sketches with the connecting elements (bolts, welds). The student is able to interpret the made sketch with the connecting elements.
5,0	The student can specify the output parameters for solving the tasks on the basis of given sketch. The student can independently modify the calculation procedures in the unusual cases. Moreover, the student is able to interpret the given drawings of elements (sections) with connectors and on that basis he can determine the output parameters to given calculations.
	EK3
2,0	The student performs the tasks assigned to him carelessly.
3,0	The student performs the tasks carefully, but he does not subject their results to discussion. Moreover, the student notes the need to discuss the result, but he cannot formulate the problem properly.
4,0	The student formulates the problem correctly, but he cannot perform the discussions about the result. The student can discuss the result using the appropriate criteria.
5,0	Moreover, the student is able to assess the impact of changes of particular criteria on the final result.
Half score 3.5 is given in the case of a full assessment of the learning outcomes for grade 3.0, but the student has not fully absorbed the learning outcomes for grade 4.0. **Half-score 4.5 is given in the case of a full assessment of the learning outcomes for grade 4.0, but the student has not fully absorbed the learning outcomes for grade 5.0**	

VII.OTHER USEFUL INFORMATIONS ABOUT THE COURSE

1.	Information where the student can see the presentations to classes, support materials and literature:
	According to the type of materials - in the classes didactic, in the room of teacher, in the library of the university and faculty.
2.	Information on the place of event classes:
	Showcased at the Faculty of Civil Engineering, Faculty of Civil Engineering website.
3.	Information on the date of the course (day of week / time):
	Showcased at the Faculty of Civil Engineering, Faculty of Civil Engineering website.
4.	Information on the consultation (hours + location):
	Schedule of consultation on the website of Faculty of Civil Engineering and on the door of the worker's room.