

**FACULTY OF CIVIL ENGINEERING****SUBJECT CARD**

**Name in English:** Metal structures - objects  
**Name in Polish:** Konstrukcje metalowe - obiekty  
**Main field of study (if applicable):** Civil Engineering  
**Specialization (if applicable):** Civil Engineering  
**Level and form of studies:** 1st/ 2nd level\*, full-time / ~~part-time~~\*  
**Kind of subject:** obligatory / ~~optional~~ / ~~university-wide~~\*  
**Subject code:** CEB007661  
**Group of courses:** YES / NO\*

	Lecture	Classes	Laboratory	Project	Seminar
Number of hours of organized classes in University (ZZU)	30			30	
Number of hours of total student workload (CNPS)	60			60	
Form of crediting	Examination / <del>crediting with grade</del> *	Examination / crediting with grade *	Examination=/crediting with grade *	<del>Examination</del> / crediting with grade *	Examination=/crediting with grade *
For group of courses mark (X) final course					
Number of ECTS points	2			2	
including number of ECTS points for practical (P) classes				2,0	
including number of ECTS points for direct teacher-student contact (BK) classes	1,1			1,1	

\* delete as appropriate

**PREREQUISITES RELATING TO KNOWLEDGE, SKILLS AND OTHER COMPETENCES**

1. Is able to determine: the cases of actions, calculation of their intensity, making of their right combination for an individual building systems.
2. Has a knowledge of the mechanics of buildings, strength of materials, shaping of elements and connections used in metal structures.
3. Is able to design and calculate connections according to PN-EN 1993-1-1, PN-EN 1993-1-5, PN-EN 1993-1-8.
4. Has a knowledge of the modelling of structures in MES and the ability to use computer software.

**SUBJECT OBJECTIVES**

- C1. To acquaint students with primary structure and the skeleton of industrial buildings, long span coverings, typical structures of tanks, silos for bulk materials, chimneys, towers masts and multi-storey buildings, and English appropriate terminology.
- C2. To acquaint students with the rules of setting the static schemes for mentioned above systems regarding their specify of actions, determining the internal forces by simplified and accurate methods of static calculations.
- C3. Training of dimensioning of steel cross-sections and members.
- C4. Developing of skills of the rational shaping of different steel structural members, division on field components, calculation of shop and site connections.

C5.	Developing of skills of description of building design and executive design, descriptive part, calculation and graphical part for different steel structures based on the example of the space regular structure.
C6.	Training of the cooperation and integration of Polish and foreign students in exchange of experience, knowledge and team work.
C7.	To deepen and strengthen the knowledge of the English terminology appropriate for different types of steel structures.

SUBJECT EDUCATIONAL EFFECTS	
<b>Relating to knowledge:</b>	
PEK_W01	Has an enlarged knowledge of: advanced topics of the strength of materials, analysis and shaping of complex steel structures, calculation of adequacy of connections of different types.
PEK_W02	Knows and understands the rules of analysis of static schemes and stability for complex strut and skin structures by simplified methods (substitutional simple schemes) and accurate methods (computer programs).
<b>Relating to skills:</b>	
PEK_U01	Is able to shape the overall geometry and the cross-sections for different types of steel structures and to set their assembling components based on the static and strength analysis.
PEK_U02	Has the ability to model and design the complex structural elements in the building and executive design.
PEK_U03	Develop the skills of designing steel structures according to Eurocode3 in English.
<b>Relating to social competences:</b>	
PEK_K01	Shows a willingness to improve professional and personal skills, extends the knowledge of technical English language.
PEK_K02	Appreciates the importance of mutual support and teamwork skills, communicates effectively in technical English vocabulary related to civil engineering.

PROGRAMME CONTENT		
Form of classes - lecture		Number of hours
Lec1	Primary structure of industrial buildings	2
Lec2	Skeleton members and cladding	2
Lec3	Bracings of industrial buildings - types and geometry	2
Lec4	Dead and imposed loads	2
Lec5	Dimensioning of main members of industrial buildings	2
Lec6	Dimensioning of main members of industrial buildings (continuation)	2
Lec7	Anchorage of main and secondary columns in the foundations	2
Lec8	Construction of long - span coverings – flat and barrel structures	2
Lec9	Construction of long - span coverings – domes	2
Lec10	Construction of long - span coverings – cable structures	2
Lec11	Tangs for liquids and silos for bulk materials	2
Lec12	Chimneys – actions, construction, design	2
Lec13	Towers – actions, construction, design	2
Lec14	Masts – actions, construction, design	2
Lec15	Skeletons of multi – storey buildings	2
<b>Total hours</b>		<b>30</b>

Form of classes - class	Number of hours
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Cl1		
...		
	<b>Total hours</b>	

<b>Form of classes - laboratory</b>		<b>Number of hours</b>
Lab1		
...		
	<b>Total hours</b>	

<b>Form of classes - project</b>		<b>Number of hours</b>
Proj1	Edition of tasks related to the space covering – discussion of rules and conditions of gaining the credit- general characteristics of steel space structures	2
Proj2	Discussion of static schemes of space structures	2
Proj3	Discussion and presentation of geometry of the space structures	2
Proj4	Dead and imposed loads acting on roof coverings	2
Proj5	Simplified calculations of space structures based on the beam and plate analogy	2
Proj6	Simplified calculations of space structures based on the beam and plate analogy (continuation)	2
Proj7	Accurate static computation based on computer programs (creation of models)	2
Proj8	Dimensioning of strut elements under axial or/and axial and bending – creation of zones	2
Proj9	Types of joints used in space structures – patent and other constructions	2
Proj10	Options of joints related to the overall geometry and assembly concept	2
Proj11	Presentation and analyses of existing student works	2
Proj12	Discussion of general rules related to the executive design for steel structures	2
Proj13	Discussion of general rules of execution of assembling and shop drawings for steel structures	2
Proj14	Discussion of current issues related with the points (proj6 - proj13)	2
Proj15	Successive testing of students' skills and the level of progress in the execution of the given task (proj6 – proj13)	2
	<b>Total hours</b>	<b>30</b>

<b>Form of classes - seminar</b>		<b>Number of hours</b>
Sem1		
...		
	<b>Total hours</b>	

<b>TEACHING TOOLS USED</b>
N1. Lecture: informative lecture, problem lectures, multimedia presentation
N2. Project: traditional and multimedia presentation, consultations

<b>EVALUATION OF SUBJECT EDUCATIONAL EFFECTS ACHIEVEMENT</b>		
<b>Evaluation</b> (F – forming (during semester), P –concluding (at semester end))	Educational effect number	Way of evaluating educational effect achievement
F1 (project)	PEK_U01	Evaluation of calculation and graphical parts of the design
	PEK_U02	
	PEK_U03	
F2 (project)	PEK_W02	Activity during problem discussions
P=0,6xF1+0,4xF2 (project)		
P (lecture)	PEK_W01	Examination
	PEK_W02	

<b>PRIMARY AND SECONDARY LITERATURE</b>
<b><u>PRIMARY LITERATURE:</u></b>
[1] Gaylord E.H., Gaylord Ch.N., Stallmeyr J.E., Design of steel structures, Mc Graw-Hill, Inc., 1992
[2] Newman A., Metal building systems, design and specifications, Mc Graw-Hill., New York 1997
[3] Łubiński M., Żółtowski W., Konstrukcje metalowe, część 2, Arkady, Warszawa 2004
[4] Biegus A., Stalowe budynki halowe, Arkady, Warszawa 2003
[5] Rykaluk K., Konstrukcje stalowe. Kominy, wieże, maszty, Oficyna Wydawnicza PWr, Wrocław 2005
[6] Trahair N.S. and others, The behaviour and design of steel structures to EC3, Fourth edition, Taylor & Francis Group, London and New York 2008
[7] Makowski Z.S., Analysis, Design and Construction of braced Barrel Vaults, Elsevier Applied Science Publishers, London 1985
<b><u>SECONDARY LITERATURE:</u></b>
[1] Bródka J. i inni., Przekrycia strukturalne, Arkady, Warszawa 1985
[2] Nooshin H., Third International Conference on Space Structures, London 1984

<b>SUBJECT SUPERVISOR (NAME AND SURNAME, DIVISION, E-MAIL ADDRESS)</b>
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MATRIX OF CORRELATION BETWEEN EDUCATIONAL EFFECTS FOR SUBJECT  
**Metal structures - objects**  
AND EDUCATIONAL EFFECTS FOR MAIN FIELD OF STUDY *Civil Engineering*  
AND SPECIALIZATION **Civil Engineering**

Subject educational effect	Correlation between subject educational effect and educational effects defined for main field of study and specialization (if applicable)**	Subject objectives ***	Programme content ***	Teaching tool number ***
<b>Knowledge</b>				
<b>PEK_W01</b>	K2_W01, K2_W02, K2_W06, K2_W07, K2S_CEB_W16	C1, C3	Lec1 to Lec15	<b>N1</b>
<b>PEK_W02</b>	K2_W04, K2_W05, K2_W06, K2_W07, K2_W09	C1, C2	Lec1 to Lec15	<b>N1</b>
<b>Skills</b>				
<b>PEK_U01</b>	K2_U01, K2_U04, K2_U12, K2S_CEB_U18	C3, C4	Proj2 to Proj15	<b>N5</b>
<b>PEK_U02</b>	K2_U07, K2_U08, K2_U09, K2_U11, K2_U12, K2S_CEB_U19	C3, C4, C5	Proj1 to Proj15	<b>N5</b>
<b>PEK_U03</b>	K2_U02, K2_U05, K2_U06	C3, C4, C5, C7	Proj2 to Proj15	<b>N5</b>
<b>Social competences</b>				
<b>PEK_K01</b>	K2_K01,	C6, C7	Lec1 to Lec15	<b>N1</b>
<b>PEK_K02</b>	K2_K02, K2_K03	C6	Proj1 to Proj15	<b>N5</b>

\*\* - enter symbols for main-field-of-study/specialization educational effects

\*\*\* - from table above