

FACULTY OF CIVIL ENGINEERING**SUBJECT CARD**

Name in Polish: Konstrukcje betonowe – obiekty
Name in English: Concrete Structures - objects
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: CEB007561
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 / crediting with grade *	Examination / crediting with grade *	Examination=/crediting with grade *	Examination / 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	

*niepotrzebne skreślić

PREREQUISITES RELATING TO KNOWLEDGE, SKILLS AND OTHER COMPETENCES

1. Student possesses the knowledge of general mechanics, mechanics (strength) of materials and the rules of general designing of building constructions.
2. Student is able to define correctly the construction and their elements calculation models, that are used for analytical and computer analysis of complex constructions.
3. He knows the principles of forming, dimensioning and constructing complex reinforced concrete structure of the building and engineering objects.
4. He is able to use selected computer software that enables to design selected complex reinforced concrete constructions.

SUBJECT OBJECTIVES

- C1. Familiarizing students with the rules of designing complex reinforced concrete constructions as a rational joint of beams, columns, shells, plates and beam-walls.
- C2. Forming the ability of independent modelling and analyzing complex, diversified reinforced concrete structures using analytical and computer calculations.
- C3. Familiarizing students with the principles of forming, calculating and constructing main reinforced concrete elements forming up: the supporting construction of volume general building and engineering building objects such as industrial buildings and multi-storey framework buildings as well as roofs, walls, bottoms and foundation of liquids tanks, silos and reinforced concrete tower buildings.

C4. Reaffirming the ability of an effective cooperation in a project team including the multi-field character of project process.

SUBJECT EDUCATIONAL EFFECTS	
Relating to knowledge:	
PEK_W01	Student knows and comprehends the rules of idealizing, numerical modelling and analyzing the complex reinforced concrete structures.
PEK_W02	Student possesses profoundly wide knowledge of analysis, dimensioning and constructing the complex reinforced concrete structures.
PEK_W03	Student is familiar with the principles of static work under the influence of diversified loads over the beam and column reinforced concrete constructions, slab reinforced concrete constructions, beam-walls reinforced concrete constructions and shell reinforced concrete constructions.
Relating to skills:	
PEK_U01	Student is able to classify and analyze analytically or numerically the complex reinforced concrete structures in relation to varied forces, and consequently, to critically assess the obtained results.
PEK_U02	Student is able to design the complex reinforced concrete constructions and prepare a necessary project documentation.
Relating to social competences:	
PEK_K01	Student is aware of importance of non-technical aspects in an engineer's work as well as of indispensability of continuous learning.
PEK_K02	Student effectively cooperates with a project team and respects the safety regulations to protect himself and the project team members during work.

PROGRAMME CONTENTS		
Form of classes - lecture		Number of hours
Lec1	Forming principles and outline of the analysis of a column-and-girder-frame construction of the industrial buildings with overhead traveling cranes.	2
Lec2	Forming, analyzing and constructing reinforced and prestressed single- and multi-span two-way reinforced concrete slabs.	2
Lec3	Forming, analyzing and constructing solid web girders and prestressed roof trusses.	2
Lec4	Designing overhead crane girders and single- or double-tee columns in industrial reinforced concrete buildings.	2
Lec5	Forming and designing the construction of the multi-storey framework reinforced concrete buildings.	2
Lec6	Designing column-and-girder constructions. Reinforcing the slab floor against punching.	2
Lec7	Forming, analyzing and constructing reinforced concrete beam- walls; designing folded plate covers.	2
Lec8	Outline of the principles of forming and usage of the reinforced concrete shells as the thin-walled constructions, used in volume general building and industrial building objects.	2
Lec9	General rules of forming the thin-walled covers. Designing monolithic and prefabricated reinforced concrete domes.	2
Lec10	Designing underground, on-the-ground and tower reinforced concrete tanks for liquids.	2
Lec11	Designing the underground and on-the-ground box-shaped (rectangular shaped) tanks for liquids used in municipal and industrial building	2
Lec12	An outline of forming and designing cooling towers, reinforced concrete chimneys and other reinforced concrete tower objects. Technological background of thin-walled reinforced concrete constructions' erection.	2

Lec13	Forming slender and corpulent silo bins as well as silo batteries in corn elevators. Principles of setting loads in silos and the outline of studies on the influence of loose materials on the silo's construction elements.	2
Lec14	Designing silos and bunkers with the diversified heights, detached and blocked ones.	2
Lec15	Technological aspects of designing thin-walled constructions made of concrete; the rules of performing proofed expansion joints and working joints.	2
	Total hours	30

Form of classes - class		Number of hours
Cl1		
...		
	Total hours	

Form of classes - laboratory		Number of hours
Lab1		
...		
	Total hours	

Form of classes - project		Number of hours
Proj1	Handing out the project topics in a field of complex reinforced concrete constructions in the form of domes and cylindrical and rectangular shaped tanks for liquids.	2
Proj2	Conditions for preparation of two initial geometrical construction variants; talking over a choice of construction materials and technological background of discussed construction variants.	2
Proj3	Approval of variant choice for a project use; talking over the rules of creating calculation models used for static analysis performed with the help of the following methods: analytical, Finite Element Method (FEM) or simplified methods	2
Proj4	Presenting the rules of compiling loads in a construction and defining the extreme inner forces. Describing the characteristics of defining the loads in tanks for liquids.	2
Proj5	Talking over static calculations with the use of analytical methods and FEM for the selected construction variant. Checking up the results applying the simplified methods.	2
Proj6	Selection of the parts of the analysed constructions for further analysis and dimensioning. Discussion over the rules of preparing building and working drawings of thin-walled reinforced concrete structures.	2
Proj7	Taking over the results of statical analysis and characteristics of thin-walled elements' dimensioning, taking into consideration ultimate and serviceability limit states	2
Proj8	Discussion over the typical mistakes and faults in analysis and preparation of the construction drawings.	2
Proj9	Discussion over the dimensioning results of the selected parts of a construction.	2
Proj10	Initial evaluation of the submitted drafts of reinforcement members.	2
Proj11	Discussion over the characteristics of outlining the thin-walled cross-sections and forming trusses and connection zones of construction component	2

	elements.	
Proj12	Evaluation of cross-section geometry, insert placement and submitted assembly and working drawings	2
Proj13	Talking over the rules of applying technical characteristics and guidelines on gathering the final project documentation.	2
Proj14	Final evaluation of submitted working drawings.	2
Proj15	Collection of the projects. Crediting with notes. Final summing-up.	2
	Total hours	30

Form of classes - seminar		Number of hours
Sem1		
...		
	Total hours	

TEACHING TOOLS USED
N1. Lecture – Informative lecture, problem-solving lecture, multimedia presentations.
N2. Project – Discussing over the project requirements, overview of possible solutions , consultations

EVALUATION OF SUBJECT EDUCATIONAL RESULTS ACHIEVEMENT		
Evaluation (F – forming (during semester), P – concluding (at semester end))	Educational result numer (reference)	Method of evaluating educational result achievement
P (project)	PEK_W01 PEK_W02 PEK_W03 PEK_U01 PEK_U02 PEK_K02	Completion of a project and its presentation
P (lecture)	PEK_W01 PEK_W02 PEK_W03 PEK_U01 PEK_U02	Exam
P (laboratory etc.) =		
P (lecture) =		

PRIMARY AND SECONDARY LITERATURE
<u>PRIMARY LITERATURE:</u>
[1] Nawy E., Concrete Construction Engineering. Handbook. CRC Press, New York 2008.
[2] Limbrunner G. F., Agdhayere A. O., Reinforced Concrete Design. Prentice Hall, New Jersey 2010.
[3] Kobiak J., Stachurski W., Konstrukcje żelbetowe, t. 2, t. 4. Arkady, Warszawa 1987, 1991.
[4] Grabiec K., Żelbetowe konstrukcje cienkościennie. PWN, Warszawa - Poznań 1999.
[5] Stachowicz A., Ziobroń W., Podziemne zbiorniki wodociągowe. Obliczenia statyczne i kształtowanie. Arkady, Warszawa 1986.
[6] Halicka A., Franczak D., Projektowanie zbiorników żelbetowych. Tom I. Zbiorniki na materiały sypkie. Wydawnictwo Naukowe PWN, Warszawa 2011.

- [7] Łapko A., Jensen B. C., Podstawy projektowania i algorytmy obliczeń konstrukcji żelbetowych. Arkady, Warszawa 2005.

SECONDARY LITERATURE:

- [1] Budownictwo Przemysłowe, t. XIII. Zbiorniki, zasobniki, silosy, kominy i maszty. Arkady, Warszawa 1966.
- [2] Starosolski W., Konstrukcje żelbetowe, t. 2. Wydawnictwo Naukowe PWN, Warszawa 2008.
- [3] Sekcja Konstrukcji Betonowych KILiW PAN, Podstawy projektowania konstrukcji żelbetowych i sprężonych według Eurokodu 2. Dolnośląskie Wydawnictwo Edukacyjne, Wrocław 2006.
- [4] Zybura A., Konstrukcje żelbetowe wg Eurokodu 2. Atlas rysunków. Wydawnictwo Naukowe PWN, Warszawa 2010.
- [5] Satereh M., Darvas R., Concrete Structures, Prentice Hall, New Jersey 2007.

SUBJECT SUPERVISOR (NAME AND SURNAME, DIVISION, E-MAIL ADDRESS)

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MATRIX OF CORRELATION BETWEEN EDUCATIONAL EFFECTS FOR SUBJECT
Concrete Structures - objects
AND EDUCATIONAAL 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 ***
Knowledge				
PEK_W01	K2S_CEB_W16, K2_W06, K2_W07, K2_W08	C1, C2, C3	Lec1 to Lec15 Proj2 to Proj14	N1 N2
PEK_W02	K2S_CEB_W18, K2_W07	C1, C3, C4	Lec1 to Lec15 Proj2 to Proj14	N1 N2
PEK_W03	K2S_CEB_W16, K2_W04	C1, C2	Lec1 to Lec15 Proj2 to Proj14	N1 N2
Skills				
PEK_U01	K2S_CEB_U18, K2S_CEB_U19, K2_U09, K2_U11	C2, C3	Lec1 to Lec15 Proj2 to Proj14	N1 N2
PEK_U02	K2S_CEB_U18, K2_U11, K2_U12	C1, C2, C3, C4	Lec1 to Lec15 Proj2 to Proj14	N1 N2
Social competence				
PEK_K01	K2_K01, K2_K02	C2, C4	Lec1 to Lec15 Proj2 to Proj14	N1 N2
PEK_K02	K2_K03	C4	Proj1 to Proj15	N2

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

*** - from table above