FACULTY OF CIVIL ENGINEERING

SUBJECT CARD

Name in English:	**Prestressed concrete structures**
Name in Polish:	**Betonowe konstrukcje sprężone**
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:	**CEB006563**
Group of courses:	**YES / ~~NO~~***

	Lecture	Classes	Laboratory	Project	Seminar
Number of hours of organized classes in University (ZZU)	**15**			**15**	
Number of hours of total student workload (CNPS)	**30**			**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	**1**			**2**	
including number of ECTS points for practical (P) classes				**2,0**	
including number of ECTS points for direct teacher-student contact (BK) classes	**0,6**			**0,6**	

* delete as appropriate

PREREQUISITES RELATING TO KNOWLEDGE, SKILLS AND OTHER COMPETENCES

1. Possesses the knowledge and understands basics of the methods used in structural mechanics, knows selected CAD software.
2. Possesses the skills of statical analysis of a bar and spatial structure.
3. Possesses the knowledge of theoretical basics of finite element method and general rules of nonlinear analysis of engineering structures.
4. Possesses the knowledge and understands calculations and detailing of a complex concrete structures – acknowledged by the grade from CEB3361.
5. Possesses the knowledge of codes and standards of design of buildings and elements.
6. Possesses the skills of using internet and other sources for searching general information and information on building engineering, He possesses the skills of using information techiques to communicate and obtaining CAD software.
7. Is responsible for honest results of his work and reliable interpretation.

SUBJECT OBJECTIVES

C1. Forming up of skills of computing and detailing of prestressed concrete structures.
C2. Learning of carrying out of multidimensional structural analysis the prestressed structures.
C3. Gaining of the knowledge of prestress techniques and methods.
C4. Gaining of the knowledge of limit state analysis of prestressed concrete structures.

SUBJECT EDUCATIONAL EFFECTS	
Relating to knowledge:	
PEK_W01	Possesses the knowledge concerning computation and detailing of complex prestressed structures.
PEK_W02	Possesses the knowledge and understands design rules of complex precast and monolithic prestressed concrete structures.
Relating to skills:	
PEK_U01	Knows how to design precast or monolithic prestressed element or part of a structure being prestressed.
PEK_U02	Knows how to check required ultimate and serviceability limit states related to prestressed structures.
PEK_U03	Possesses the knowledge how to use respective codes, standards and literature
Relating to social competences:	
PEK_K01	Knows how to extend the knowledge on contemporary concrete structures and design methods.
PEK_K02	He is responsible for honest results of his design.

PROGRAMME CONTENT		
Form of classes - lecture		**Number of hours**
Lec1	The concept of prestressing, historical review, definitions, diferences between prestressed and reinforced concrete.	1
Lec2	Concrete used in prestressed structures, mechanical, physical and deformational properties, HPC and special concrete.	1
Lec3	Prestressing steel – strength, deformations, types and geometry, durability.	1
Lec4	Pretensioned concrete – bond between steel and concrete, prestressing methods and devices.	1
Lec5	Posttensioned concrete – cable and achnorage types, ducts, methods of prestressing and injection, elements folded from segments	1
Lec6	Axisymmetric structures, tanks, pipes, special prestressing methods.	1
Lec7	Design calculation of prestressed element, linear stress and limit states method, loss of prestress force in pre- and post-tensioned concrete.	1
Lec9	Design of pretensioned beams, selection of section's dimensions, prestressing force, design situations, ultimate and serviceability limit states, detailing.	1
Lec10	Projektowanie belek kablobetonowych, kształtowanie przekroju i trasy kabli, stany graniczne, strefa przypodporowa i strefa docisku, belki ciągłe	1
Lec11	Design of prestressed compound structures, protection against delimitation, capacity, cracking and deflection, reinforcement detailing.	1
Lec12	Structures prestressed with unbonded tendons.	1
Lec13	Examples of prestressed structures – roofs and floors (girders, hollow core and TT slabs, shell elements), halls and frame structures, tanks, bridges, viaducts.	1
Lec14	Mass production elements – ties, pipes, electrical poles, gantry beams, etc. .	1
Lec15	Durability of prestressed structures, corrosion of concrete and reinforcement, fire and fatigue resistance.	1
	Total hours	**15**

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

Form of classes - laboratory		Number of hours
Lab1		
	Total hours	

In the frame of the project – computer exercises (15 hours) with applying of the packet of statistical and geostatistical programs of ISATIS – the version of Isatis 2013.1, dongle key USB connected with the software Isatis purchased in the Firm Geovariances, Avon, Ecole des Mines de Paris, France.

Form of classes - project		Number of hours
Proj1	Subject area scope, projects titles submission.	1
Proj2	Basic assumption and rules.	1
Proj3	Examples of structures.	1
Proj4	Preliminary calculations of elements dimensions.	1
Proj5	Rules governing modelling of a structure in computing software.	1
Proj6	Verification of static computation. Load combinations used in ultimate and serviceability limit states.	1
Proj7	Calculation of prestress loss: instantaneous loss.	1
Proj8	Calculation of prestress loss: instantaneous loss.	1
Proj9	Calculation of prestress loss: rheologicalloss..	1
Proj10	Calculation of prestress forces used in design.	1
Proj11	Limitation of stress during tensioning.	1
Proj12	Checking ultimate limit states.	1
Proj13	Checking servicebility limit states.	1
Proj14	Detailed problems related to anchorage, shear and fatigue.	1
Proj15	Drawings of prestressed structures.	1
	Total hours	**15**

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

TEACHING TOOLS USED
N1. Lecture: Information lecture, problematic lecture, multimedial presentations.
N2. Project: Presentation of the project scope, examples of structures, direct collaboration and discussion with Students.

EVALUATION OF SUBJECT EDUCATIONAL EFFECTS ACHIEVEMENT		
Evaluation (F – forming (during semester), P – concluding (at semester end)	Educational effect number	Way of evaluating educational effect achievement
F1 (evaluation of loads and preliminary dimensions of a structure)	PEK_W01 PEK_U01 PEK_U03 PEK_K01 PEK_K02	Evaluation of the project part

F2 (static computations with load combinantions finshed)	PEK_W01 PEK_U01 PEK_U03 PEK_K01 PEK_K02	Evaluation of the project part
F3(prestress loss calculated)	PEK_W01 PEK_W02 PEK_U01 PEK_U03 PEK_K01 PEK_K02	Evaluation of the project part
F4 (calculations of limit states finished)	PEK_W01 PEK_W02 PEK_U01 PEK_U03 PEK_K01 PEK_K02	Evaluation of the project part
F5 (drawing and specification finished)	PEK_W01 PEK_W02 PEK_U01 PEK_U02 PEK_U03 PEK_K01 PEK_K02	Evaluation of the whole project with grade
P = 0,1xF1+0,2xF2+0,2xF3+0,2xF4+0,3xF5		
P (lecture)	PEK_W01 PEK_W02 PEK_K01	Colloquium

PRIMARY AND SECONDARY LITERATURE

PRIMARY LITERATURE:

[1] Teng S., Kong F. K.: Reinforced and Prestressed Concrete: Eurocodes Taylor & Francis Ltd; 2009.

[2] Navy E. G.: Pre-stressed Concrete. A Fundamental Approach. Prentice Hall, Upper Saddle River, New Jersey 07458, 2000.

SECONDARY LITERATURE:

[1] Ghali A.: Circular storage tanks and silos. E & FN Spon, London 2000.

[2] Raju N. K., Pre-stressed concrete, 2008.

[3] Fogarasi G., Pre-stressed concrete technology, 1986.

[4] Hurst M. K.: Prestressed Concrete Design Taylor & Francis, 1998.

[5] EN 1992-1-1: Eurocode 2: Design of concrete structures-Part 1-1: General rules and rules for buildings.

[6] EN 1992-3: Eurocode 2: Design of concrete structures-Part 3: Liquid retaining and containing structures.

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

Roman WRÓBLEWSKI, Department of Concrete Construction, roman.wroblewski@pwr.edu.pl

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MATRIX OF CORRELATION BETWEEN EDUCATIONAL EFFECTS FOR SUBJECT
Prestressed concrete structures
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 ***
Knowledge				
PEK_W01	K2_W06, K2_W07, K2_W09, K2_W10, K2S_CEB_W16, K2S_CEB_W22	C1, C3, C4	Wy1-Wy8 Pr1-Pr14	N1 N2
PEK_W02	K2_W07, K2_W09, K2_W10, K2S_CEB_W16, K2S_CEB_W22	C2,	Wy9-Wy10 Pr9-Pr12	N1 N2
Skills				
PEK_U01	K2_U04, K2_U05, K2_U11, K2_U12, K2_U17, K2S_CEB_U18, K2S_CEB_U23	C1, C2,C4	Wy1-Wy8 Pr1-Pr14	N1 N2
PEK_U02	K2_U04, K2_U05, K2_U11, K2_U12, K_U17, K2S_CEB_U18, K2S_CEB_U23	C4	Wy9-Wy10 Pr9-Pr12	N1 N2
PEK_U03	K2_U01	C3,C4	Wy11-Wy15	N1
Social competence				
PEK_K01	K2_K01	C3	Wy1-Wy15	N1
PEK_K02	K2_K03	C1, C2	Pr1-Pr14	N2

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