CZESTOCHOWA UNIWERSITY OF TECHNOLOGY
FACULTY OF CIVIL ENGINEERING
DEPARTMENT OF BUILDING AND ENGINEERING STRUCTURES
CARD OF DESCRIPTION COURSE

Name of course						Code of course	Year / Semester	
Prestressed structures *Konstrukcje sprężone*						**WB_BUD_D_II_KSP_02_KBI**	**I**	**2**
Type of course						Level of qualification	ECTS	
Lecture	Practice	Laboratory	Design	Seminar	Exam	Stationary second cycle programme		
2	**-**	**-**	**2**	**-**	**E**	**S2**	**6**	
Specialities:						**Type of course:**		
• **Building and Engineering Structures**						**choose**		
Unit administrating study:						***DEPARTMENT OF BUILDING AND ENGINEERING STRUCTURES***		
						Room 94	***tel./fax: +48 (34) 325 09 24***	
Study language:						**Polish / English**		
Person leading of course:						**Dr Eng. Roman GĄĆKOWSKI**	**rgack@wp.pl**	

I. CARD OF COURSE	
OBJECTIVE OF THE SUBJECT	
C1	Understanding the essence of prestressed structures as engineering.
C2	Acquires the design skills and calculation of bearing capacity of advanced cross sections prestressed elements by ULS and SLS.
C3	Design of prestressed structures using the acquired knowledge in the field of engineering with a full-time first degree.
PREREQUISITES FOR KNOWLEDGE, SKILLS AND OTHER COMPETENCE	
1	Basic knowledge of concrete technology, properties of physical, chemical, mechanical, concrete and reinforcing steel.
2	Basic knowledge of theoretical mechanics and strength of materials and the ability of calculating the ratios of strength sections.
3	Messages from structural mechanics and ability to solve advanced static systems.
4	Knowledge of mechanics and foundations soil prestressed structures.
5	Ability to use standard EC0, EC1, EC2 and professional literature.
6	Knowledge of and ability to use the software for the calculation of static and durability of building structures and engineering.
LEARNING OUTCOMES	
EK1	has an orderly, theoretically founded general knowledge necessary to understand advanced work of prestressed construction.
EK2	has a detailed knowledge useful for solving advanced engineering tasks in the field of prestressed construction.
General skills	
EK3	the student is able obtain information from the literature and other materials, including catalogs of manufacturers of components for prestressed structures in the Polish and English language.
EK4	the student able to individually solve advanced tasks.
Fundamental engineering skills	
EK5	the student able to use computer programs to perform advanced calculation models of prestressed structures.
Skills directly related to solving an engineering tasks	
EK6	the student able to correct an analysis advanced work of prestressed structures and on this fundamentals to determine the scope of the calculation.

Competence of personal and social	
EK7	the student able to think and act creatively and systematically doing the design of a prestressed structures.

CONTENTS OF COURSE		
Form of teaching – Lectures		**Number of hours**
W01	The history of prestressed structures.	2
W02	Advantages and types of prestressing.	2
W03	Pre-tensioning and post-tensioning systems and devices.	2
W04	Mechanical properties of concrete and steel in prestressed structures.	2
W05	Losses in prestress.	2
W06	Analysis of members under axial load and flexure.	2
W07	Design of members.	2
W08	Design of sections for flexure.	2
W09	Analysis for shear and torsion.	2
W10	Calculation of deflection and crack width.	2
W11	Transmission of prestress.	2
W12	Cantilever and continuous beams.	2
W13	Composite sections.	2
W14	One-way and two-way slabs.	2
W15	Compression members and circular prestressing.	2
	TOTAL:	**30**

Form of teaching – Design		Number of hours
Pr01	Introduction to use of standards and regulations.	2
Pr02	Edition theme of the design. The work schedule.	2
Pr03	Summary of loads. Finding the element dimensions of prestressed structures.	4
Pr04		
Pr 05	The construction of calculation models. Static calculations.	6
Pr 06		
Pr 07		
Pr 08	Strength calculation of prestressed elements based on static calculations.	4
Pr 09		
Pr 10	Calculation of bearings and expansion joints of prestressed structures.	2
Pr 11	The preparation of complete documentation of the design descriptive.	4
Pr 12		
Pr 13	Preparation of complete technical drawings of the design.	4
Pr 14		
Pr 15	Assessment of the design.	2
	TOTAL:	**30**

TOOLS OF TEACHING	
1.	Lecture: presentation of multimedia content lectures.
2.	Design: multimedia presentation, discussion.
3.	Materials copyright lecturers. Consultation.
4.	Literature. Standards of work timber structures EC0, EC1, EC2
5.	Software for the calculation of static and strength of engineering structures.

METHODS OF ASSESSMENT: (F - FORMATIVE; P - SUMMARY)	
F1	Assessment independently prepare for classes.

F2	Assessment of the implementation of the design outside the classroom.
P1	Assessment develop a calculation model of the prestressed structures.
P2	Assessment of analysis results of calculations internal forces and combinatory of loads.
P3	Assessment of the implementation documentation descriptive and graphic of the prestressed structures.

WORKLOAD OF STUDENT			
O.n.	**Activity**	**Average number of hours/ECTS to complete the activity**	
		[hours.]	**[ECTS]**
1.	Hours of classes organized by the universities - **Lectures**.	**30**	**6**
2.	Contact hours of teacher connected with lectures.	30	
3.	Introduction to with the indicated literature.	30	
4.	Hours of classes organized by the universities - **Design**.	**30**	
5.	Contact hours of teacher connected with design.	30	
6.	Implementation of the design.	30	
	TOTAL:	**180**	

BASIC AND SUPPLEMENTARY LITERATURE	
1.	Ajdukiewicz A., Mames J.: Konstrukcje z betonu sprężonego. Polski Cement. Kraków 2004.
2.	Calgaro J.A., Tschumi M., Shetty N.: Designers' Guide to Eurocode 1: *Designers' Guide to Eurocode 1: Actions on Bridges: EN 1991-2, EN 1991-1-1, -1-3 to 1-7 and EN 1990 Annex A2*. ICE Technical Publications. London 2010.
	Cook N.: *Designers' Guide to EN 1991-1-4 Eurocode 1: Actions on structures, general actions part 1-4. Wind actions.* ICE Technical Publications. London 2007.
3.	Gąćkowski R.: *Tablice i algorytmy do wymiarowania zginanych elementów żelbetowych*. Wyd. Verlag Dashofer. Warszawa 2013.
4.	Gulvanessian H., Calgaro J.A., Holický M.: *Designers' Guide to Eurocode: Basis of Structural Design, 2nd edition.* ICE Technical Publications. London 2012.
5.	Hendy C.R., Smith D.A., Gulvanessian H.: *Designers' Guide to EN 1992-2. Eurocode 2: Design of concrete structures. Part 2: Concrete Bridges.* ICE Technical Publications. London 2013.
6.	Knauff M.: *Obliczanie konstrukcji żelbetowych według Eurokodu 2.* PWN. Warszawa 2012.
7.	Mosley W.H., Hulse R., Bungey J.H.: *Reinforced Concrete Design to Eurocode 2.* Seventh Edition. Palgrave macmillan. Singapore 2012.
8.	Narayanan R.S., Beeby A: *Designers guide to Eurocode 2: Design of concreto structures. Designers Guide to EN 1992-1-1 and EN 1992-1-2 Eurocode 2: Design of concrete structures. General rules and rules for buildings and structural fire design.* ICE Technical Publications. London 2013.
9.	Nawy E.G.: Prestressed Concrete a fundamental approach. Pearson Education. New Jersey 2003.
10.	Sekcja Konstrukcji Betonowych KILiW PAN: Podstawy projektowania konstrukcji żelbetowych i sprężonych według Eurokodu 2. DWE. Wrocław 2006.
11.	Strasky J.: *Stress Ribbon and Cable-supported Pedestrian Bridges.* ICE Technical Publications. London 2011.
12.	Swart J.P.: *Glossary & Terms in Bridge Engineering*. Published by: J.p. Swart on 23 Octobr 2011.
13.	Wai-Fah Chen, Lian Duan,: *Bridge engineering Substructure design.* CRC Press. Boca Raton London, New York, Washington. Taylor & Francis Group, LLC. 2003
14.	Dziennik Ustaw Nr 63 Poz. 735. *Rozporządzenie Ministra Transportu i Gospodarki Morskiej z dnia 30 maja 2000 r. w sprawie warunków technicznych, jakim powinny odpowiadać drogowe obiekty inżynierskie i ich usytuowanie.*
15.	Dziennik Ustaw Nr 43 Poz. 430. *Rozporządzenie Ministra Transportu i Gospodarki Morskiej z dnia 2 marca 1999 r. w sprawie warunków technicznych, jakim powinny odpowiadać drogi publiczne i ich usytuowanie.*
16.	EN 1990 - Eurocode*: Basis of structural design*.
17.	EN 1991:2002. Eurocode 1*: Actions on structures.* Part 1-1: General actions. Densities, self-

	weight, imposed loads for buildings. March 2009.
18.	EN 1991:2005. Eurocode 1. *Actions on structures.* Part 1-4: General actions. Wind actions. January 2010.
19.	EN 1991:2003. Eurocode 1: *Actions on structures.* Part 2: Traffic loads on bridges. February 2010.
20.	EN 1992:2004. Eurocode 2: *Design of concrete structures.* Part 1-1: General rules and rules for buildings. January 2008.
21.	EN 1992:2005. Eurocode 2. *Design of concrete structures.* Part 2: Concrete bridges. Design and detailing rules. July 2008.

MATRIX OF IMPLEMENTATION EFFECTS OF EDUCATION FOR DIRECTION

The effect of learning	The reference given effect to the effects defined for the entire program (PEK)	Objectives of the course	Program content	Tools of teaching	Method for assessing
EK1	KBI_W02, KBI_W03	C1, C2, C3	W01÷W06, W11÷W15 Pr01÷ Pr04	1, 2, 3, 4	F1, F2, P3
EK2	KBI_W04	C1, C2, C3	W07÷W12 Pr01÷ Pr04	1, 2, 3, 4	F1, F2, P3
EK3	KBI_U01	C1, C2	W01÷W04, W12÷W15 Pr01÷ Pr04	1, 2, 3, 4	F1, F2, P1, P2
EK4	KBI_U03	C2, C3	Pr03÷ Pr06, Pr11, Pr12	2, 3, 4, 5	P1, P2
EK5	KBI_U04	C2, C3	Pr07÷ Pr11	2, 3, 4, 5	P2, P3
EK6	KBI_U04	C2, C3	Pr05÷ Pr11	2, 3, 4, 5	P2, P3
EK7	KBI_K01, KBI_K02	C2, C3	Pr03÷ Pr07 Pr11÷ Pr15	2, 3, 4, 5	P1, P2, P3

II. METHODS OF ASSESSMENT – DETAILS

MARKS	LEARNING OUTCOME
	EK-01
2,0	The student knows only the basic terms relating to prestressed and has a cursory knowledge of dimensioning of prestressed structures.
3,0	The student completed the knowledge of new terminology and symbols for the construction of prestressed and general knowledge of advanced methods for modeling prestressed structures.
3,5	The student can explain in further detail the work of any of the prestressed structures and the loads acting on them. He knows the advanced part modeling prestressed structures.
4,0	The student can explain in further detail the work of any of the prestressed structures and the loads acting on them. He knows the advanced methods of modeling design.
4,5	The student is able to partially put into practice designed prestressed structures using advanced computational methods and partly to identify environmental hazards, know methods to prevent their effects.
5,0	The student is able to use it in practice prestressed designed using advanced computational methods and identify environmental hazards, know methods to prevent their effects.
	EK-02
2,0	The student knows the principles of modeling and briefly the work of individual elements of prestressed structures.
3,0	The student knows the principles of modeling and operation of components of prestressed structures but has trouble with their interpretation, knows the rules of dimensioning briefly in prestressed structures.
3,5	Can partially correctly perform and interpret advanced computational models of prestressed structures and to determine their application, knows the rules of dimensioning individual components of prestressed structures.
4,0	Able to properly perform and interpret advanced computational models of prestressed structures and to determine their application, knows the rules of dimensioning individual components of prestressed structures.
4,5	The student knows the partially advanced principles and objectives of the calculation of prestressed structures by ULS and SLS, and understand their importance.

5,0	Advanced student knows in detail the principles and objectives of prestressed structures by calculating the ULS and SLS, and understand their importance.
EK-03	
2,0	The student knows the basic sources of literature needed for the design of prestressed structures.
3,0	The student knows the applicable standards and can use them in the design (EC0, EC1, EC2).
3,5	The student is able to partially take advantage of all standards and link them throughout the process of design of prestressed structures (EC0, EC1, EC2).
4,0	The student is able to use all of the standards and link them throughout the process of design of prestressed structures (EC0, EC1, EC2).
4,5	Moreover the student completed message in the standards of knowledge given in the literature but can't fully exploit it.
5,0	Moreover the student completed message in the standards of knowledge given in the literature.
EK-04	
2,0	The student are unable to perform work on the design and don't know the advanced methods of calculation of prestressed structures.
3,0	The student is able to provide a general outline of the design, requires the control to the design at the initial stage, he can partially perform advanced computational models of prestressed structures.
3,5	The student is able to partially identify the issues made in implementing the design, but not able to use the recommendations of code. Able to perform partial advanced computational models.
4,0	Moreover the student is able to identify complex issues in implementing the design, but not able to use the recommendations of code. He can perform advanced computational models.
4,5	The student is able to identify the issues advanced in implementing the design, but it can't fully utilize the recommendations of code.
5,0	The student is able to identify the issues advanced in implementing the design and is able to use the recommendations of code.
EK-05	
2,0	The student isn't aware of what to create the correct procedures and computational models.
3,0	The student can build procedures and computational models but has difficulty in asking loads on structures.
3,5	The student is able to partially build procedures and computational models of the prestressed structure. He can ask properly load on structures. Has difficulty in interpreting the results of static calculations.
4,0	The student can build procedures and computational models of the prestressed structure. He can ask properly load on structures. Has difficulty in interpreting the results of static calculations.
4,5	The student can individually build advanced procedures and computational models, ask properly load but has trouble performing the correct analysis of the results of static.
5,0	The student can individually build advanced procedures and computational models, ask properly load and perform static analysis of the results.
EK-06	
2,0	The student doesn't understand the specifics of the construction of prestressed structures.
3,0	The student is able to identify and understand some technical issues occurring in the design.
3,5	The student identifies and partially understand the technical issues occurring in the design.
4,0	The student identifies and understands the technical issues occurring in the design.
4,5	The student is able to partially fix addition compounds with the work of construction.
5,0	The student is able to establish relationships in addition to the work of construction.
EK-07	
2,0	The student performs tasks assigned to him carelessly without the commitment and with delay.
3,0	The student performs tasks with commitment, on time but the share classes is passive.
3,5	Moreover the student actively participates in the activities but it isn't creative.
4,0	Moreover the student takes an active part in the activities and partly creative.
4,5	Moreover the student takes an active part in classes and being creative.
5,0	Moreover the student shows creativity and originality.

III.	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):
	The timetable posted on the door of Room 89 at the Faculty of Civil Engineering at. Academic 3 (third floor).