FACULTY OF CIVIL ENGINEERING

SUBJECT CARD

Name in English:	**Advanced computer aided engineering**
Name in Polish:	**Zaawansowane komputerowe wspomaganie projektowania**
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:	**CEB007761**
Group of courses:	**~~YES~~ / NO***

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

* delete as appropriate

PREREQUISITES RELATING TO KNOWLEDGE, SKILLS AND OTHER COMPETENCES

1. Able to identify and to define loads acting on complex building structures.
2. Knows standards and the guidelines and regulations for the design of buildings and their components.
3. Has a developed theoretical knowledge and skills for dimensioning and construction of elements and complex building structures.
4. Has the ability to model complex 2D and 3D structures using FEM.

SUBJECT OBJECTIVES

C1. Developing and strengthening ability of applying methods of modeling and design of complex, spatial constructions using computer programs.
C2. Understanding the theoretical foundations of computer modeling of complex buildings and the interpretation and verification of results, including the issues of non-linearity and dynamic range.
C3. Acquiring the ability to select and use the software used in design practice for solving spatial complex buildings.

SUBJECT EDUCATIONAL EFFECTS	
Relating to knowledge:	
PEK_W01	Knows and understands the principles of computer-aided modeling, calculation and dimensioning of complicated spatial structures and solving mechanics and structural analysis of 2D and 3D in the linear and non-linear statics, dynamics and stability.
Relating to skills:	
PEK_U01	Can select and use computer programs for analysis and design of complex structures.
PEK_U02	Can model in the environment of the finite element method, defines calculation model; can define and perform advanced linear and non-linear analysis of complex 2D and 3D engineering structures.
PEK_U03	Can properly interpret and critically evaluate the results of numerical analysis of complex engineering structures.
Relating to social competences:	
PEK_K01	Able to work on the implementation of tasks independently or in a team project (preparation of presentations and report-projects); is responsible for the accuracy of the results of the work and its correct interpretation.
PEK_K02	Is aware of the need to increase knowledge in the field of contemporary techniques and software for the design of building structures.

PROGRAMME CONTENT		
Form of classes - lecture		**Number of hours**
Lec1		
…		
	Total hours	

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

Form of classes - laboratory		**Number of hours**
Lab1	Introduction: Training of health and safety rules. Discussion of the examination rules. Set a schedule of classes. Overview and introduction to computational programs used in relation to the 3D problems.	2
Lab2	Presentation of the principles of computer modeling using FEM of complex engineering structures - examples for 3D bar structures, plates and shields.	2
Lab3	Presentation of the principles of computer modeling using FEM of complex engineering structures - examples for shells and solids.	2
Lab4	Analysis of the possibilities of using software to support engineering design for use in the verification of the results of laboratory tests.	2
Lab5	Solving examples of complex building and engineering structures - examples prepared by the students.	2
Lab6	Solving examples of complex building and engineering structures - examples prepared by the students.	2

Lab7	Solving examples of complex building and engineering structures - examples prepared by the students.	2
Lab8	Solving examples of complex building and engineering structures – verification test.	2
Lab9	Modeling and solving examples of complex constructions in terms of research - design of plates and shields (eg Lusas).	2
Lab10	Modeling and solving examples of complex constructions in terms of research - design of shells and solids (eg Lusas).	2
Lab11	Construction optimization problems – introduction to modeling (eg Solver).	
Lab12	Construction optimization problems of bar structures – solving examples (eg Solver).	2
Lab13	Construction optimization problems of bar structures – solving examples (np. Solver).	2
Lab14	Shape optimization problems (eg ESO).	
Lab15	Summary. Discussion. Final verification. Crediting.	2
	Total hours	**30**

Form of classes - project		**Number of hours**
Proj1		
…		
	Total hours	

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

TEACHING TOOLS USED	
N1.	Laboratory: multimedia presentations, defining and solving of problems using software, discussion of results.
N2.	Contact hours.

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	PEK_W01, PEK_U01, PEK_U02, PEK_U03	Verification test - solution examples during lab.
F2	PEK_U01, PEK_U02, PEK_U03, PEK_K01, PEK_K02	Presentation and report of solution of own design problem.
P = 0,4xF1+0,55xF2+0,05xPRESENCE		

PRIMARY AND SECONDARY LITERATURE
PRIMARY LITERATURE: [1] Zienkiewicz O. C., Taylor R. L., Zhu J. Z., The Finite Element Method, Sixth Edition, McGraw-Hill, 2005. [2] McCormack J., Structural Analysis Using Classical and Matrix Methods, John Wiley & Sons, 2007. [3] Rombach G. A., Finite-element design of concrete structures, Practical problems and their solutions, ICE publishing, 2011. [4] Arora J. S., Optimum design, McGraw-Hill, Inc., 1989 (ex.). [5] Program manuals (Robot, Lusas). **SECONDARY LITERATURE:** [1] http://www.issmo.org/. [2] http://www.esc.auckland.ac.nz/teaching. [3] Computers & Structures, *Elsevier*; http://www.elsevier.com. [4] Structural and Multidisciplinary Optimization, *Springer-Verlag*; http://vls2.icm.edu.pl. [5] Akin J. E., Finite elements analysis concepts via SolidWorks, World Scientific, 2010. [6] Rombach G.A., Finite-element design of concrete Structures, ice publishing, 2011.

SUBJECT SUPERVISOR (NAME AND SURNAME, DIVISION, E-MAIL ADDRESS)
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MATRIX OF CORRELATION BETWEEN EDUCATIONAL EFFECTS FOR SUBJECT
Advanced computer aided engineering
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_W03, K2_W04, K2_W05, K2_W06, K2_W07, K2_W09, K2S_CEB_W16, K2S_CEB_W22	C1, C2	Lab1 - Lab15	N1
Skills				
PEK_U01	K2_U04, K2_U05, K2_U06, K2_U07, K2_U08, K2_U09, K2_U11, K2_U12, K2S_CEB_U18, K2S_CEB_U19, K2S_CEB_U23	C1, C2, C3	Lab1 - Lab15	N1, N2
PEK_U02	K2_U04, K2_U05, K2_U06, K2_U07, K2_U08, K2_U09, K2_U11, K2_U12, K2S_CEB_U18, K2S_CEB_U19, K2S_CEB_U23	C1, C2, C3	Lab1 - Lab15	N1, N2
PEK_U03	K2_U04, K2_U05, K2_U06, K2_U07, K2_U08, K2_U09, K2_U11, K2_U12, K2S_CEB_U18, K2S_CEB_U19, K2S_CEB_U23	C1, C2, C3	Lab1 - Lab15	N1, N2
Social competence				
PEK_K01	K2_K01, K2_K02, K2_K03	C3	Lab1 - Lab15	N1
PEK_K02	K2_K01, K2_K02, K2_K03	C3	Lab1 - Lab15	N1

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