FACULTY OF CIVIL ENGINEERING

SUBJECT CARD

Name in English:	**Selected topics in structural mechanics**
Name in Polish:	**Statyka budowli – wybrane zagadnienia**
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:	**CEB008461**
Group of courses:	**~~YES~~ / NO***

	Lecture	Classes	Laboratory	Project	Seminar
Number of hours of organized classes in University (ZZU)	**30**	**15**	**15**		
Number of hours of total student workload (CNPS)					
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	**3**	**1**	**1**		
including number of ECTS points for practical (P) classes		**0,5**	**1,0**		
including number of ECTS points for direct teacher-student contact (BK) classes	**1,1**	**0,7**	**0,7**		

* delete as appropriate

PREREQUISITES RELATING TO KNOWLEDGE, SKILLS AND OTHER COMPETENCES

1. The student has knowledge and skills in the determination of internal forces (internal) and the rules for their labeling for plane rod systems statically determinate.
2. The student knows solving methods of statically determinate rod systems and can effectively determine the reactions and internal forces (internal) in the rod system.
3. The student has a theoretical basis and the ability to apply the principle of virtual work to determine static variables in statically determinate systems such as beams, frames and trusses.

SUBJECT OBJECTIVES

C1. Learning the methodology of determining displacements in statically determinate systems and gaining the skills of displacement determination in plane rod systems from mechanical and non-mechanical loads.

C2. Learning the methodology of solving of statically indeterminate systems by the force method and develop skills of determining internal forces (internal) in flat rod systems from mechanical and non-mechanical loads.

C3. Learning the methodology of solving of geometrically indeterminate systems by the displacement method and gaining skills of determining internal forces (internal) in plane rod systems subjected to non-mechanical loads.

C4.	Learning the methods of determining the influence lines and gaining skills of their determination in the case of plane rod systems; statically determinate and indeterminate.
C5.	Gaining skills of solving simple rod structural systems using analytical methods as well as modeling, solving and verifying the results using computer computational software.
C6.	Gaining awareness of the continuing education need to improve own competences in the modern computer programs for structural analysis issues.

SUBJECT EDUCATIONAL EFFECTS	
Relating to knowledge:	
PEK_W01	The student has an in-depth knowledge of principles of structural mechanics with respect to statically determinate and indeterminate bar structures.
PEK_W02	The student knows solving methods of internal forces and displacements of statically determinate and indeterminate plane bar structures subjected to mechanical and not mechanical loads.
PEK_W03	The student knows methods of influence line determination for statically determinate and indeterminate bar systems
Relating to skills:	
PEK_U01	The student can perform static analysis of plane bar structures statically determinate and indeterminate which can be subjected to mechanical or non-mechanical loads.
PEK_U02	The student can determine influence lines of bar structures statically determinate and indeterminate.
PEK_U03	The student can properly define computational model of plane bar structures and their components, and carry out analysis of internal forces and displacements determination.
Relating to social competences:	
PEK_K01	The student is able to work on the implementation of tasks independently or in a team (individual preparation of reports and cooperative problem solving in the classroom)
PEK_K02	The student is aware of the need to increase knowledge in the field of contemporary techniques and programs for calculation of building structures.

PROGRAMME CONTENT		
Form of classes - lecture		**Number of hours**
Lec1	Introduction. Discussion of the topic subject. Principles of virtual work for rod systems. Reciprocity theorems. Elastic constrains.	2
Lec2	Determination of displacement field in plane rod structures subjected to mechanical load. Methods for effective numerical integration of internal forces charts. Examples.	2
Lec3	Impact of support displacements and temperature variation on the movement of statically determinate systems. Examples.	2
Lec4	The force method for plane rod systems. Theoretical basis. Derivation of the canonical equations.	2
Lec5	Determination of the displacement field of the rod system using the method of forces. Examples.	2
Lec6	The force method. Determination of internal forces induced by mechanical loading. Verification of the correctness of the solution. Examples.	2
Lec7	Determination of the displacement field induced by support's	2

	displacement using the force method. Examples.	
Lec8	Determination of the displacement field induced by temperature variation using the force method. Examples.	2
Lec9	Displacement method. Theoretical foundations.	2
Lec10	Displacement method. Transformation's rules according to the theory of first-order. Formulation of the canonical equations of displacement method. Verification of the correctness of the solution.	2
Lec11	Displacement method. Determination of internal forces induced by mechanical loads. Examples.	2
Lec12	Displacement method. Determination of internal forces induced by non-mechanical loads. Examples.	2
Lec13	Method of influence line determination in statically determinate and indeterminate rod structures. Theoretical foundations.	2
Lec14	Influence line determination using static approach. Examples.	2
Lec15	Influence line determination using kinematic approach. Examples.	2
	Total hours	**30**

Form of classes - class		**Number of hours**
Cl1	Preliminary information. Introduction into force method. Solving a simple example presenting methodology of governing system of equations forming according to the force method.	2
Cl2	The force method: determination of internal forces induced by mechanical loads. Computational examples.	2
Cl3	The force method: determination of internal forces induced by non-mechanical loads. Computational examples.	2
Cl4	Displacement method – introduction. Computational example presenting the main idea of the displacement method.	2
Cl5	Displacement method: determination of internal forces induced by mechanical loads. Computational examples.	2
Cl6	Displacement method: determination of internal forces induced by non-mechanical loads. Computational examples.	2
Cl7	Influence lines: kinematic and static approach. Computational examples.	2
Cl8	Influence lines. Further computational examples.	1
	Total hours	**15**

Form of classes - laboratory		**Number of hours**
Lab1	Introductory information. The theme of the 1st laboratory exercise. The calculation example with presentation of the computer software. Performing own calculations with computer computational software and results discussion.	2
Lab2	Further calculations with the computational program based on the force method. Calculation example.	2
Lab3	The 1st laboratory exercise. The case of support displacement and temperaturę variation. Performing own numerical calculation.	2
Lab4	Test verifying the student knowledge regarding the 1st laboratory exercise. The theme of 2nd laboratory exercise. Displacement method. Calculation example. Performing own numerical calculation.	2
Lab5	Numerical calculation of rod structure using the computer software based on the displacement method. The mechanical loading case.	2

Lab6	Numerical calculation of rod structure using the computer software based on the displacement method. The case of support displacement and temperaturę variation.	2
Lab7	The computer software of influence line determination. The final test.	2
Lab8	The final verification of laboratory reports.	1
	Total hours	**15**

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

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

TEACHING TOOLS USED	
N1.	Classic lecture. Multimedial presentation.
N2.	Laboratory: classic and multimedial presentation regarding laboratory, presentation of computer software, examples of problem solution with computer software..
N3.	Consulting. Teaching materials prepared by the teacher.
N4.	Class: classic and multimedial presentation, solving the examples.

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(laboratory)	PEK_U01, PEK_U02, PEK_U03, PEK_K01	Test verifying knowledge regarding 1st laboratory exercise. Active participation during class.
F2(laboratory)	PEK_U01, PEK_U02, PEK_U03, PEK_K01	Test verifying knowledge regarding 2nd laboratory exercise. Active participation during class.
P (laboratory) = F1 x 1/2 + F2 x 1/2		
F1(class)	PEK_U01, PEK_U02, PEK_U03, PEK_K01	Test verifying student knowledge of force method. Active participation during class.
F2(class)	PEK_U01, PEK_U02, PEK_U03, PEK_K01	Test verifying student knowledge of displacement method. Active participation during class.
P (class) = F1 x 1/2 + F2 x 1/2		
P (lecture)	PEK_W01, PEK_W02, PEK_W03, PEK_K02	Final written exam – questions on theory and practical problems.

PRIMARY AND SECONDARY LITERATURE
PRIMARY LITERATURE: [1] 1. Przemieniecki S., Theory of Structural Analysis, MacGraw-Hill, New York, 1968. [2] Meller M., English through civil engineering, Politechnika Koszalińska – Wyd. Uczelniane, 1998. [3] Mase G.E., Theory and problems of continuum mechanics, MacGraw-Hill, New York, 1970. [4] Pilkey W.D., Wunderlich W., Mechanics of structures. Variational and computational methods, CRC Press, Boca Raton, 1994. **SECONDARY LITERATURE:** [1] 1. Ross C.T.F., Finite element methods in structural mechanics, 1985. [2] Reddy J.N., Applied functional analysis and variational methods in engineering, MacGraw-Hill, New York, 1986.

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MATRIX OF CORRELATION BETWEEN EDUCATIONAL EFFECTS FOR SUBJECT
Selected topics in structural mechanics
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, K2S_CEB_W16	C1, C2, C3, C4	Lec1 - Lec12	N1,N3
PEK_W02	K2_W04, K2_W05, K2S_CEB_W16	C2, C3	Lec4 - Lec12	N1,N3
PEK_W03	K2_W04	C4	Lec13, Lec14, Lec15	N1,N3
Skills				
PEK_U01	K2_U06, K2_U07, K2_U09, K2S_CEB_U19	C1, C2, C3, C5	Lab1 - Lab6, Cl1 - Cl6	N2, N3, N4
PEK_U02	K2_U07, K2S_CEB_U19	C4, C5	Lab7, Cla7, Cla8	N2, N3, N4
PEK_U03	K2_U07, K2S_CEB_U19	C2, C3, C4, C5	Lab1 - Lab7	N2, N3
Social competence				
PEK_K01	K2_K03	C5	Lab1 - Lab7, Cl1 - Cl8	N2, N3, N4
PEK_K02	K2_K01	C6	Lab1 - Lab7	N2, N3

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