Field of study (Kierunek):

Civil Engineering (Budownictwo)

Subject Description Card (Karta Opisu Przedmiotu)

ISCED 2013-F Field of study: Building and civil engineering (code: 0732)

Name of the subject				Subject code		Semester
Structural Mechanics II *Mechanika konstrukcji II*						**Spring**
Subject		**Profile**		**Level of education**		
Facultative		**General academic**		**Full-time**		
Type of classes						**ECTS**
Lecture	**Practice**	**Laboratory**	**Project**	**Seminar**	**Exam**	
15	**-15**	**-**	**30**	**-**	**YES**	**6**
Faculty conducting subject:	***Faculty of Civil Engineering*** ***Tel: +48 (34) 325 09 04*** ***mail: maksym.grzywinski@pcz.pl***					
Teachers conducting subject:	***Assoc. Prof. Maksym Grzywiński***					

I. Card subject	
PURPOSE OF THE SUBJECT	
C01	To understand the concept of static and kinematic indeterminacy (degrees of freedom) of the structures such as trusses, beams, and rigid pin jointed frames.
C02	Skills of solving systems of statically indeterminate by the Force Method (FM) and the Displacement Method (DM).
C03	To apply various methods for analyzing the indeterminate structures to evaluate the response of such structures in the form of bending moment, shear force, axial force etc.
PRELIMINARY REQUIREMENTS FOR KNOWLEDGE, SKILLS AND OTHER COMPETENCES	
1	Knowledge of Mathematics in the field of mathematical analysis.
2	Knowledge of Mechanics and Strength of Material.
3	Completed course Structural Mechanics I.
LEARNING OUTCOMES:	
Knowledge: the graduate knows and understands	
EK1	Knowledge of Structural Mechanics II and the ability to use the conceptual apparatus of mechanics in the formulation of practical engineering construction.
Skills: the graduate can	
EK2	Can use literature sources and other materials relating to the engineering problem to be solved. Can make a classification of buildings, construction of supporting structures.
Social competence: the student is ready to	
EK3	solve statically indeterminate systems by the Force Method (FM); solve statically indeterminate systems by the Displacement Method (DM).

PROGRAM CONTENT		
Type of classes - Lecture		**Number of hours**
L1	Type of structures and loads	1
L2	Degree of indeterminate static systems. Introduction to the Force Method.	1
L3	The Force Method for trusses. Displacements for statically indeterminate systems.	1
L4	The Force Method for beams.	1
L5 **L6**	Equation of Three Moment (3M) for continuous beams.	2
L7 **L8**	The Force Method for plane frame.	2
L9	Degree of indeterminate kinematic systems (rotations and displacement). Introduction to the Displacement Method.	1
L10	The equations of transformation and the canonical equations of Displacement Method.	1
L11 **L12**	Slope-Deflection Method - continuous beams, frames.	2
L13 **L14**	Moment Distribution Method - continuous beams, frames.	2
L15	Repertory before written exam	1
	TOTAL:	**15**

PROGRAM CONTENT		
Type of classes - Practice		**Number of hours**
PT1 **PT2**	Determination of the degree of static indeterminate systems. Solving beams and frames statically indeterminate using the Force Method of canonical equations, calculation of load displacement unit and the external loads to the core systems.	2
PT3	Solving statically indeterminate 2D trusses using the Force Method.	1
PT4 **PT5**	Solving statically indeterminate beams, and 2D frames using the Force Method.	2
PT6 **PT7**	Solving multi-span beams by the equation of Three Moment (3M).	2
PT8 **PT9**	Test #1 (Force Method)	2
PT10	Determination of the degree of kinematic indeterminate systems. Displacement Method.	1
PT11 **PT12**	Solving continuous beams and 2D frames of statically indeterminate.	2
PT13 **PT14**	Test #2 (Displacement Method)	2
PT15	The use of symmetry and asymmetry in the structure calculations.	1
	TOTAL:	**15**

PROGRAM CONTENT		
Type of classes - Project		**Number of hours**
P1	Application guidelines for the project #1 - statically indeterminate continuous beam.	2
P2	Discussion of the Force Method (FM). Adoption of the basic system, saving the canonical system of equations. Determination of internal forces in beam. Calculation of displacements for the basic system.	2
P3	The solution of the canonical equations. The calculation of the forces in the beam of the real. Execution control calculations by checking the compatibility of deformations.	2
P4	Discussion of the equation Three Moments (3M).	2
P5 **P6**	Adoption of the basic system. Writing equations and calculating overtime bending moments. Plotting the internal forces of the beam statically indeterminate.	4

P7	Comparison of the results of project #1 using the Method of Displacements (DM). Calculation of the actual bending moments in principle of superposition.	2
P8	Determination of the degree of kinematic indeterminate, the adoption of the basic system, the calculation of the actual displacement of the system. Defense of the project #1.	2
P9 **P10**	Application guidelines for the project #2 - statically indeterminate frame. Displacement Method for sliding frames. Determination of the degree of kinematic indeterminate frame, the adoption of the basic system.	4
P11 **P12**	Determination of the actual movements of the canonical system of equations Displacement Method (DM). The calculation of bending moments in principle of superposition.	4
P13	Calculation of displacements for the basic frame. The solution of the canonical equations. Comparison of the results with the Force Method (FM).	2
P14	Plotting the internal forces statically indeterminate frame using the principle of superposition. Design validation calculations.	2
P15	Defense of the project #2.	2
	TOTAL:	**30**

BASIC AND ADDITIONAL LITERATURE	
Basic literature:	
1.	Hibbeler R.C.: Structural Analysis, 8 edition, Prentice Hall, 2012
Additional literature:	
1.	Bhavikatti S.S.: Structural Analysis-II, 4 edition, Vikas , 2013
2.	Kassimali A.: Structural Analysis, 6 edition, Cengage, 2020
3.	Khalfallah S.: Structural Analysis 2. Statically Indeterminate Structures, Wiley, 2018
4.	Olsson K.G., Dahlblom O.: Structural Mechanics, Wiley, 2016
5.	Smith P.S.: An Introduction to Structural Mechanics, Palgrave Macmillan, 2001