Annex No. 9
to the Rector's Decision No. 35/19
as amended by Decision No. 12/22

COURSE SPECIFICATION

Course code	full-time:	**B1-5-501a**
	part-time:	**BN1-5-501a**
Course title in Polish	**Metody obliczeniowe w mechanice konstrukcji 1**	
Course title in English	**Computational Methods in Structural Mechanics 1**	
Valid from academic year	**2023/2024**	

CURRICULAR ALIGNMENT

Programme	**CIVIL ENGINEERING**
Level	**first-cycle**
Programme profile	**academic**
Mode of attendance	**full-time; part-time**
Specialism	**all**
Academic unit responsible for the course	**Department of Theory of Structures and BIM**
Course coordinator	**dr inż. Katarzyna Kubicka**
Approved by	**prof. dr hab. inż. Grzegorz Świt**

COURSE DESCRIPTION

Teaching block		**major**
Course status		**elective**
Language of instruction		**Polish**
Semester of delivery	full-time	**semester V**
	part-time	**semester V**
Prerequisites		**Mathematics 1, 2, 3, Strength of Materials 1 and 2, Structural Mechanics 1**
Exam (YES/NO)		**NO**
ECTS		**3**

Mode of teaching		**lecture**	**class**	**lab**	**project**	**other**
Number of hours per semester	full-time:	**15**			**30**	
	part-time:	**10**			**20**	

LEARNING OUTCOMES

Category	Code	Learning outcomes	Corresponding programme outcome code
Knowledge	W01	Students have the knowledge to build selected problems of mechanics.	B1_W01 B1_W06 B1_W07
	W02	Students are familiar with some computer programs that support structural calculations.	B1_W17
Skills	U01	Students know how to formulate mathematical models of selected topics in mechanics.	B1_U08
	U02	Students know how to apply the finite element method to solve mechanics problems.	B1_U01
	U03	Students are able to use computer programs supporting the calculation process.	B1_U27
	U04	Students can perform an evaluation of the solutions obtained.	B1_U12
Competence	K01	Students are able to work individually.	B1_K01
	K02	Students are responsible for the reliability of the results obtained.	B1_K02
	K03	Students describe the results obtained and formulate conclusions	B1_K04

COURSE CONTENT

Teaching mode*	Topics covered
lecture	Real, mathematical, and numerical models of basic building structural elements. Static diagrams of bar structures.
	Introduction to the finite element method (FEM). Definition of: shape function, stiffness matrix, load vector. The FE algorithm.
	Beam, truss and frame elements in FEA.
	Beam-elastic substrate model.
	Verification of the correctness of FEM calculations.
project	Introduction to the selected computer program: interface, basic functions, program configuration settings.
	Modeling of elementary bar structures.
	Determination of the cross-section force envelope using available computer tools.
	Static analysis of orthogonal beam and frame by finite element method on non-deformable substrate.
	Static analysis of the frame-truss structure.
	Static analysis of a beam on a deformable substrate in FEA (modeling of the soil substrate).

METHODS OF LEARNING OUTCOMES VERIFICATION

Learning outcome	Learning outcome verification methods					
	Oral exam	Written exam	Test	Project	Report	Other
W01			X	X		
W02				X		
U01			X	X		
U02			X	X		
U03				X		
U04			X	X		
K01			X	X		
K02			X	X		
K03				X		

ASSESSMENT

Teaching mode*	Assessment type	Criteria
lecture	mark-based	*The pass mark is a minimum of 50% for the in-class test.*
project	mark-based	*At least a passing grade on each project*

STUDENT WORKLOAD

ECTS weighting												
	Activities	Student workload										
		full-time					part-time					
1.	Scheduled contact hours	W	C	L	P	S	W	C	L	P	S	h
		15			30		10			20		
2.	Other (office hours, exams)	2			2		2			2		h
3.	**Total number of contact hours**	**49**					**34**					h
4.	**Number of ECTS credits for contact hours**	**2**					**1,4**					ECTS
5.	**Independent study hours**	**26**					**41**					h
6.	**Number of ECTS credits for independent study**	**1**					**1,6**					ECTS
7.	**Practical hours**	**50**					**50**					h
8.	**Number of ECTS credits for practical hours**	**2**					**2**					ECTS
9.	**Total workload**	**75**					**75**					h
10.	**ECTS credits for the course** *1 ECTS credit =25 student learning hours*	**3**										ECTS

READING LIST

1. Rakowski G., Kacprzyk Z.: Metoda elementów skończonych w mechanice konstrukcji. Oficyna Wydawnicza Politechniki Warszawskiej, Warszawa,2016.
2. Borowicz T., Buczkowski M., Szaniec W.: Metoda elementów skończonych: podstawy rozwiązywania konstrukcji prętowych: konspekt wykładów i ćwiczeń. Wydawnictwo Politechniki Świętokrzyskiej, Kielce, 2000.
3. Sadecka L.: Metoda różnic skończonych i elementów skończonych w zagadnieniach mechaniki konstrukcji i podłoża. Oficyna Wydawnicza Politechniki Opolskiej, Opole, 2010.
4. Zienkiewicz O.C., Taylor R.L., Zhu J.Z.: The finite element methods: its basis and fundamentals, Elsevier: Butterworth-Heinemann, Amsterdam 2006.