MODULE SPECIFICATION

Module code	
Module title in Polish	**Metody obliczeniowe w mechanice konstrukcji**
Module title in English	**Computational Methods in Structural Mechanics**
Module running from the academic year	**2016/2017**

A. MODULE IN THE CONTEXT OF THE PROGRAMME OF STUDY

Field of study	**Civil Engineering**
Level of qualification	**First cycle** *(first cycle, second cycle)*
Studies profile	**Academic** (*academic/practical)*
Mode of study	**Full-time** *(full-time / part-time)*
Specialism	
Organisational unit responsible for module delivery	**The Department of Mechanics, Metal Structures and Computer Methods**
Module co-ordinator	**Prof. Czesław Cichoń, PhD hab., Eng.**
Approved by	**Marek Iwański, Professor**

B. MODULE OVERVIEW

Module type	**Core module** (*core/programme-specific/elective HES*)*
Module status	**Compulsory module** *(compulsory / non-compulsory)*
Language of module delivery	**English**
Semester in the programme of study in which the module is taught	**Semester 5**
Semester in the academic year in which the module is taught	**Winter semester** *(winter / summer)*
Pre-requisites	**None** (*module code/module title, where appropriate)*
Examination required	**No** *(yes / no)*
ECTS credits	**3**

Mode of instruction	**lectures**	**classes**	**laboratories**	**project**	**others**
Total hours per semester	**15**		**30**		

* elective HES − elective modules in the Humanities and Economic and Social Sciences

C. LEARNING OUTCOMES AND ASSESSMENT METHODS

Module aims	The aim of the module is to acquire the ability to formulate mathematical models and computational models of the finite difference method and the finite elements method for linear problems of structural mechanics and to solve them with the use of simple computer programs.

Module outcome code	Module learning outcomes	Mode of instruction *(l/c/lab/p/ others)*	Corresponding programme outcome code	Corresponding discipline-specific outcome code
W_01	A student is familiar with building mathematical models for the selected problems concerning mechanics.	l	B_W01 B_W06 B_W07	T1A_W01 T1A_W02 T1A_W03 T1A_W04 T1A_W06 T1A_W07
W_02	A student knows some computer programs supporting structure calculations.	l/l	B_W17	T1A_W01 T1A_W02 T1A_W05 T1A_W07
U_01	A student can formulate mathematical models of the selected issues concerning mechanics.	l/l	B_U08	T1A_U07 T1A_U08 T1A_U09 T1A_U15
U_02	A student can apply computer methods: finite element method and finite difference method to solve problems concerning mechanics.	l/l	B_U01 B_U12	T1A_U01 T1A_U07 T1A_U08 T1A_U09 T1A_U14 T1A_U15
U_03	A student can use computer programs supporting computational process.	l	B_U27	T1A_U01 T1A_U02 T1A_U04 T1A_U05 T1A_U09 T1A_U15 T1A_U16
U_04	A student can analyze the obtained results.	l	B_U12	T1A_U01 T1A_U07 T1A_U08 T1A_U09 T1A_U14 T1A_U15
K_01	A student can work individually.	l	B_K01	T1A_K01 T1A_K03 T1A_K04
K_02	A student is responsible for the reliability of the obtained results.	l	B_K02	T1A_K02 T1A_K05 T1A_K07
K_03	A student formulates conclusions and describes the results of his/her own work.	l	B_K04	T1A_K01 T1A_K07

Module content:

1. Topics to be covered in the lectures

No.	Topics	Module outcome

		code
1-3	Local and global formulation of problems in structural mechanics; the classification of second-order partial differential equations; a diagram of the computer structure analysis.	W_01 U_01
4-9	The finite difference method. Local formulation of the finite difference method; selection of stencils and generation of differential diagrams; generation of Finite Difference Method (FDM) equations; solution of the bending of beam using FDM; solution of the bending of slab using FDM; the application of FDM to solve parabolic and hyperbolic equations.	W_01 U_01 U_02
10-15	The Finite Element Method (FEM). FEM algorithm, sample solutions of statics of the planar rod structures (a beam, a truss); assessment of solution quality; equations of dynamic equilibrium using FEM; free vibrations; sample solution for a frame.	W_01 U_01 U_02

2. Topics to be covered in the classes
3. Topics to be covered in the laboratories

Project number	Topics	Module outcome code
1	Introduction to MathCAD.	W_01 U_01
2 - 4	Solution of an elliptical problem using FDM (P1, MathCAD).	W_02 U_02 U_03 U_04 K_01 K_02
5	Sample FDM solutions of parabolic and hyperbolic equations.	W_01 U_01
6	Introduction to Matlab.	W_01 U_01
7 - 9	FEM solution of a static problem for a simple frame (P2, MathCAD, and Mathlab).	W_02 U_02 U_03 U_04 K_01 K_02
10	Formulating FEM equations for a problem of a fixed heat transfer in the 2D region, a sample.	W_01 U_01 U_02
11- 12	FEM solution of a fixed heat transfer in the 2D region (P3, MathCAD).	W_02 U_02 U_03 U_04 K_01 K_02
13 - 15	FEM solution of free vibrations in a frame (P4, MathCAD, Matlab).	W_02 U_02 U_03 U_04 K_01 K_02

Assessment methods

Module outcome code	**Assessment methods** *(Method of assessment; for module skills − reference to specific project, laboratory and similar tasks)*
W_01	A test and a project
W_02	A project
U_01	A test and a project
U_02	A test and a project
U_03	A project
U_04	A project
K_01	A test and a project
K_02	A test and a project
K_03	A test and a project

C. STUDENT LEARNING ACTIVITIES

ECTS summary		
	Type of learning activity	**Study time/ credits**
1	Contact hours: participation in lectures	**15**
2	Contact hours: participation in classes	
3	Contact hours: participation in laboratories	**30**
4	Contact hours: attendance at office hours (2-3 appointments per semester)	**3**
5	Contact hours: participation in project-based classes	
6	Contact hours: meetings with a project module leader	
7	Contact hours: attendance at an examination	
8		
9	**Number of contact hours**	**48** *(total)*
10	**Number of ECTS credits for contact hours** *(1 ECTS credit =25-30 hours of study time)*	**1.9**
11	Private study hours: background reading for lectures	**3**
12	Private study hours: preparation for classes	
13	Private study hours: preparation for tests	**3**
14	Private study hours: preparation for laboratories	
15	Private study hours: writing reports	
16	Private study hours: preparation for a final test in laboratories	
17	Private study hours: preparation of a project/a design specification	**10**
18	Private study hours: preparation for an examination	
19		**19** *(total)*
20	**Number of private study hours**	**0.8**
21	**Number of ECTS credits for private study hours** *(1 ECTS credit =25-30 hours of study time)*	**67**
22	**Total study time**	**67**
23	**Total ECTS credits for the module** *(1 ECTS credit =25-30 hours of study time)*	**3**
24	**Number of practice-based hours**	**46**

	Total practice-based hours	
25	**Number of ECTS credits for practice-based hours** *(1 ECTS credit =25-30 hours of study time)*	**1.8**