

## MODULE SPECIFICATION

Module code	
Module title in Polish	<b>Technologia Betonów Mrozoodpornych</b>
Module title in English	<b>Technology of Frost-Resistant Concretes</b>
Module running from the academic year	<b>2016/2017</b>

### A. MODULE IN THE CONTEXT OF THE PROGRAMME OF STUDY

Field of study	<b>Civil Engineering</b>
Level of qualification	<b>First cycle</b> <i>(first cycle, second cycle)</i>
Studies profile	<b>Academic</b> <i>(academic/practical)</i>
Mode of study	<b>Full-time</b> <i>(full-time / part-time)</i>
Specialism	<b>Technology and Organization of Civil Engineering</b>
Organisational unit responsible for module delivery	<b>Department of Civil Engineering Technology and Organization</b>
Module co-ordinator	<b>Prof. Zbigniew Rusin, PhD hab., Eng.,</b>
Approved by	<b>Marek Iwański, Professor</b>

### B. MODULE OVERVIEW

Module type	<b>Core module</b> <i>(core/programme-specific/elective HES*)</i>
Module status	<b>Compulsory module</b> <i>(compulsory / non-compulsory)</i>
Language of module delivery	<b>English</b>
Semester in the programme of study in which the module is taught	<b>Semester 7</b>
Semester in the academic year in which the module is taught	<b>Winter semester</b> <i>(winter / summer)</i>
Pre-requisites	<b>None</b> <i>(module code/module title, where appropriate)</i>
Examination required	<b>No</b> <i>(yes / no)</i>
ECTS credits	<b>2</b>

Mode of instruction	lectures	classes	laboratories	project	others
<b>Total hours per semester</b>	<b>15</b>			<b>15</b>	

\* elective HES – elective modules in the Humanities and Economic and Social Sciences

### C. LEARNING OUTCOMES AND ASSESSMENT METHODS

<b>Module aims</b>	T The aim of the module is to acquire students with the principles of designing, assessing, and realising frost-resistant concretes. Another aim is to broaden students' knowledge on the reasons of frost-related damages of concrete elements as well as the applied methods of assessing frost-resistance of concretes.
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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 knows and understands basic physical mechanisms responsible for the displacement, gathering and phase changes on concrete pores.	l/p	B_W01 B_W13 B_W18 B_W19	T1A_W01 T1A_W02 T1A_W03 T1A_W04 T1A_W05 T1A_W06 T1A_W07 T1A_W08
W_02	A student has general knowledge on designing Frost-resistant concretes, the range of their application as well as test methods.	l/p	B_W08 B_W13 B_W18 B_W19	T1A_W01 T1A_W02 T1A_W03 T1A_W04 T1A_W05 T1A_W06 T1A_W07 T1A_W08
U_01	A student can design a concrete mix which meets the requirements for frost-resistant structures.	p	B_U24	T1A_U03 T1A_U05 T1A_U08 T1A_U09 T1A_U13 T1A_U14 T1A_U15 T1A_U16
K_01	A student can notice system and economic aspects while formulating and solving an engineering task.	l/p	B_K08	T1A_K02 T1A_K05

#### Module content:

##### 1. Topics to be covered in the lectures

No.	Topics	Module outcome code
1	Introduction, discussing the contents of the lectures. The classification of frost-related damages of concrete structures. Constructional and climatic conditions of frost resistance as regards constructional elements. Discussing the EN 206 norm.	W_01 K_01
2	The properties of free and adsorbed water. The structure of water, surface tension, density, viscosity, water phase transitions, and the properties of ice.	W_01
3	The genesis and geometrical characteristics of pores in concrete. The displacement and gathering water in concrete: diffusion, adsorption, physical condensation, and capillary pressure.	W_01 W_02
4	The phenomena of freezing and melting water in concrete pores. The impact of melting salts (NaCl) on the change of absorbability and freezing conditions.	W_01
5	The impact of the water-cement ratio on frost-resistance, the production of frost-resistant concretes without applying aerating means and microspheres.	W_02

6	Aerating concrete mixes; the methods and aerating means; the characteristics of air pores and its shaping; the coefficient of spatial distribution of pores.	W_02
7	The types of aggregates and cements in terms of their usefulness for frost-resistant concretes. The methods of examining concrete mixes and hardened concretes.	W_02
8	A test.	W_01 W_02 K_01

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

Project number	Topics	Module outcome code
1 - 3	Discussing the methods of designing concrete with the required frost-resistance; discussing project assumptions; determining applicable exploitation and environmental conditions for concrete; determining the requirements concerning concrete mix and concrete.	U_01 W_02 K_01
4 - 5	Quantitative and qualitative selection of components for concrete with the required frost resistance; selecting the methods and control procedure of concrete frost resistance.	U_01 K_01
6 - 7	Selecting the technology of making a concrete structure with determined frost resistance.	U_01

### Assessment methods

Module outcome code	Assessment methods <i>(Method of assessment; for module skills – reference to specific project, laboratory and similar tasks)</i>
W_01	A test
W_02	A test and defending a project
U_01	Defending a project
K_01	A test and defending a project

### C. STUDENT LEARNING ACTIVITIES

ECTS summary		
	Type of learning activity	Study time/ credits
1	Contact hours: participation in lectures	<b>15</b>
2	Contact hours: participation in classes	
3	Contact hours: participation in laboratories	
4	Contact hours: attendance at office hours (2-3 appointments per semester)	<b>2</b>
5	Contact hours: participation in project-based classes	<b>15</b>
6	Contact hours: meetings with a project module leader	
7	Contact hours: attendance at an examination	
8		

9	<b>Number of contact hours</b>	<b>32</b> <i>(total)</i>
10	<b>Number of ECTS credits for contact hours</b> <i>(1 ECTS credit =25-30 hours of study time)</i>	<b>1.3</b>
11	Private study hours: background reading for lectures	<b>7</b>
12	Private study hours: preparation for classes	
13	Private study hours: preparation for tests	<b>5</b>
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	<b>10</b>
18	Private study hours: preparation for an examination	
19		
20	<b>Number of private study hours</b>	<b>22</b> <i>(total)</i>
21	<b>Number of ECTS credits for private study hours</b> <i>(1 ECTS credit =25-30 hours of study time)</i>	<b>0.9</b>
22	<b>Total study time</b>	<b>54</b>
23	<b>Total ECTS credits for the module</b> <i>(1 ECTS credit =25-30 hours of study time)</i>	<b>2</b>
24	<b>Number of practice-based hours</b> <i>Total practice-based hours</i>	<b>27</b>
25	<b>Number of ECTS credits for practice-based hours</b> <i>(1 ECTS credit =25-30 hours of study time)</i>	<b>1.1</b>