

Politechnika Świętokrzyska wydział budownictwa i architektury

Annex No. 9 to the Rector's Decision No. 35/19

as amended by Decision No. 12/22

COURSE SPECIFICATION

Course code	full-time:	B1-6-TiOB-608, B1-7-TiOB-707					
	part-time:	BN1-7-TiOB-709					
Course title in Polish	Technologia Betonów Mrozoodpornych 1 Technologia Betonów Mrozoodpornych 2 Technologia Betonów Mrozoodpornych 1 and 2						
Course title in English	Technology of Frost-Resistant Concretes						
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	Construction Technology and Project Management
Academic unit responsible for the course	Department of Construction Technology and Management
Course coordinator	prof. dr hab. inż. Jerzy Wawrzeńczyk
Approved by	prof. dr hab. inż. Grzegorz Świt

COURSE DESCRIPTION

Teaching block		specialism specific
Course status		required
Language of instruction		Polish
	full-time	semester VI, semester VII
Semester of delivery	part-time	semester VII
Prerequisites		Concrete Technology, Technology of Concrete Work
Exam (YES/NO)		NO
ECTS		2

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

LEARNING OUTCOMES

Category	ory Code Learning outcomes					
Knowledge	W01	Students know and understand the basic physical mechanisms responsible for the displacement, accumulation, and phase transformations of water in the pores of concrete.	B1_W01 B1_W13 B1_W18 B1_W19			
Knowledge	W02	Students have a general knowledge of the frost-resistant concrete design, application scope, and test methods.	B1_W08 B1_W13 B1_W18 B1_W19			
	U01	Students can design a concrete mix that meets the requirements for frost-resistant structures.	B1_U24			
Skills	kills U02 Students can carry out tests on concrete mixture for air- entrainment, physical characteristics, and frost resistance of concrete.		B1_U23			
Competence	K01	Students can see the systemic and economic aspects of an engineering task when formulating and solving it.	B1_K01			

COURSE CONTENT

Teaching mode*	Topics covered
	Classification of frost damage of concrete structures. Structural and climate-related determinants of frost durability of structural elements. Overview of the EN 206 standard.
	Properties of free and adsorbed water. Structure of water, its surface tension, density, viscosity, and phase transformations; properties of ice.
lastura	Origin and geometrical characteristics of pores in concrete. Movement and accumulation of water in concrete: diffusion, adsorption, physical condensation, capillary pressure
lecture	Freezing and thawing of water in the pores of concrete. Effect of de-icing salts (NaCl) on the change of water absorption and freezing conditions.
	Effect of W/C ratio on frost resistance; production of frost-resistant concretes without aerating agents or microspheres.
	Air-entrainment of concrete mixtures; air-entrainment methods and agents; air pore characteristics and its formation, the coefficient of spatial distribution of pores.
	Types of aggregates and cements in the context of suitability for frost-resistant concretes. Methods of testing concrete mixtures and hardened concretes.
	Health and Safety Training.
	Indication of suitable operating and environmental conditions for concrete. Determination of the requirements for concrete mix in strictly defined operational conditions, selected individually.
	Methods of designing concrete with the required frost resistance.
lab	Quantitative and qualitative selection of components for concrete with the required frost resistance (cement, aggregate, admixtures, additives, mixing water).
	Preparing of a series of reference concretes based on developed formulas, air- entrained conventionally and with the addition of polymer microspheres. Applying
	selected test methods for concrete mixture air-entrainment.
	Selection of methods and procedures for controlling the frost resistance of concrete (European, American and Scandinavian standards), performance of tests for the
	physical characteristics and frost resistance of a series of concretes.

METHODS OF LEARNING OUTCOMES VERIFICATION

Learning outcome	Learning outcome verification methods									
	Oral exam	Written exam	Test	Project	Report	Other				
W01			Х							
W02			Х	Х						
U01				Х	X					
U02				Х	X					
K01				Х	X					

ASSESSMENT

Teaching mode*	Assessment type	Criteria
lecture	mark-based	Scoring at least 50% of the points from the test.
lab	mark-based	Correct execution of the project and obtaining at least 50% of the points from the project defense. Obtaining at least 50% of the points from the test.

STUDENT WORKLOAD

ECTS weighting												
	Activities Student workload											
	Activities	full-time						ра	rt-tir	ne		
1	4 Cohedulad context hours	W	С	L	Ρ	S	W	С	L	Ρ	S	h
1.	Scheduled contact hours	15		15			10		10			
2.	Other (office hours, exams)	2		2			2		2			h
3.	Total number of contact hours		34						24			h
4.	Number of ECTS credits for contact hours		1,4				1					ECTS
5.	Independent study hours		16				26					h
6.	Number of ECTS credits for independent study		0,6				1					ECTS
7.	Practical hours		25			25				h		
8.	Number of ECTS credits for practical hours	1 1					ECTS					
9.	Total workload	al workload 50 50						h				
10. ECTS credits for the course 2 1 ECTS credit =25 student learning hours 2												

READING LIST

- 1. Wawrzeńczyk J.: Metody badania i prognozowania mrozoodporności betonu Kielce, 2017.
- 2. Pigeon M., Pleau R.: Durability of concrete in cold climates. E & FN SPON, London, 1995.
- 3. Neville A. M.: Właściwości betonu. Polski Cement, Kraków, 2000.
- 4. Kurdowski W.: Chemia cementu i betonu. Wydawnictwo Polski Cement & PWN, Warszawa, 2010.
- 5. Rusin Z.: Technologia betonów mrozoodpornych. Wydawnictwo Polski Cement, Kraków 2002

- 6. Peukert S.: Cementy powszechnego użytku i specjalne. Wydawnictwo Polski Cement, Kraków 2000.
- Praca zbiorowa pod kierunkiem L. Czarneckiego, Beton według normy PN-EN 206-1- komentarz. Polski Cement & PKN, Kraków, 2007.
- 8. Fagerlund G.: Trwałość konstrukcji betonowych. Arkady, 1997.