

# Tadeusz Kosciuszko Cracow University of Technology

## Course Card

Faculty of Civil Engineering

Field of study: Civil Engineering

Study profile: general academic

Study form: full-time

Field of study code: BUD

Study cycle: 1st

Specialty: no specialty

### 1 COURSE INFORMATION

Course name	Technologia betonu
Course name in English	Technology of Concrete
Course code	WIL BUD oIS C23 24/25
Course category	Basic
No. of ECTS points	3.00
Semester	3

### 2 CLASS TYPE, NUMBER OF HOURS ACCORDING TO THE STUDY PLAN

Semester	Lecture	Class exercise	Laboratory	Computer lab	Design exercise	Seminar
3	15	15	15	0	0	0

### 3 COURSE OBJECTIVES

**Objective 1** TO FAMILIARIZE STUDENTS WITH CONSTITUENT MATERIALS FOR ORDINARY CONCRETE, THEIR PROPERTIES, TEST METHODS AND REQUIREMENTS.

**Objective 2** TO FAMILIARIZE STUDENTS WITH BASIC PHENOMENONS OCCURRING IN CEMENT PASTE.

**Objective 3** TO FAMILIARIZE STUDENTS WITH RULES OF DESIGNING OF CONCRETE MIXTURE COMPO- SITION AND MEASUREMENTS OF ITS BASIC PROPERTIES.

**Objective 4** TO FAMILIARIZE STUDENTS WITH BASIC PROPERTIES OF HARDENED CONCRETE, METHODS OF THEIR TESTING AND GENERAL QUALITY CONTROL PRINCIPLES.

**Objective 5** TO FAMILIARIZE STUDENTS WITH BASIC TECHNOLOGICAL PROCESSES AND THEIR INFLU- ENCE ON FINAL PROPERTIES OF CONCRETE IN A MEMBER OR A STRUCTURE

**Objective 6** TO PREPARE STUDENTS FOR TEAM WORKING

**Objective 7** TO PREPARE STUDENTS FOR RESEARCH

## **4 PREREQUISITES IN TERMS OF KNOWLEDGE, SKILLS AND OTHER COMPETENCES**

**1** BASIC KNOWLEDGE ON CHEMISTRY AND PROPERTIES OF MINERAL BINDERS

**2** BASIC KNOWLEDGE ON STRENGTH OF MATERIALS

## **5 LEARNING OUTCOMES**

**LO1 Knowledge** A STUDENT KNOWS BASIC GROUPS OF CONSTITUENTS MATERILAS OF ORDINARY CONCRETE AND THEIR GENERAL ROLE IN THE CONCRETE.

**LO2 Skills** A STUDENT KNOWS BASIC PROCESSES OCCURING IN CEMENT PASTE.

**LO3 Knowledge** A STUDENT KNOWS BASIC RELATIONSHIPS BETWEEN CONCRETE COMPOSITION AND PROPERTIES OF FRESH AND HARDENED CONCRETE.

**LO4 Skills** A STUDENT KNOWS BASIC PROPERTIES OF HARDENED CONCRETE

**LO5 Skills** A STUDENT KNOWS BASIC TECHNOLOGICAL PROCESSES AND CAN EXPLAIN THEIR INFLUENCE ON QUALITY OF HARDENED CONCRETE.

**LO6 Knowledge** A STUDENT CAN DESIGN COMPOSITION OF ORDINARY CONCRETE OF ASSUMED PROPERTIES.

**LO7 Skills** A STUDENT CAN CARRY OUT LABORATORY TESTS OF BASIC PROPERTIES OF CONCRETE CONSTITUENT MATERIALS, FRESH AND HARDENED CONCRETE.

**LO8 Knowledge** A STUDENT CAN WORK INDIVIDUALLY AND COOPERATE IN A TEAM ON AN ASSIGNED TASK.

**LO9 Knowledge** A STUDENT IS RESPONSIBLE FOR THE RELIABILITY OF THE ACHIE- VED RESULTS OF HIS/HER WORK AND THEIR INTERPRETATION.

## **6 COURSE CONTENT**

Laboratory		
No.	Subject matter of the course Detailed description of thematic blocks	No. of class hours
L1	Testing basic properties of cement. Making paste of standard consistence for determination of setting time. Making standard mortar and preparation of specimens for cement strength test. Testing cement flexural and compressive strength and determination of cement class.	2

Laboratory		
No.	Subject matter of the course Detailed description of thematic blocks	No. of class hours
<b>L2</b>	Testing basic properties of aggregate: sieve analysis, determination of loose and compacted bulk densities, determination of tightness and voids content. Selection of optimal aggregate grading for concrete by a method of successive approximations.	2
<b>L3</b>	Making concrete mixture designed by a trial method. Testing its basic properties: density, consistence (by slump test, Vebe test, Degree of compatibility test and flow table test), air content by pressure method. Moulding specimens for strength tests.	2
<b>L4</b>	Approval of assumptions and correction of calculations of concrete composition for individually assigned subjects of a design project.	3
<b>L5</b>	Testing basic properties of hardened concrete: density, compressive strength, flexural strength, tensile splitting strength. Determination of compressive strength class of the concrete. Demonstration of stands for testing freeze/thaw resistance and water permeability of concrete.	2
<b>L6</b>	Non-destructive testing: presentation of basic methods of testing hardened concrete in a structure. Determination of rebound number with a sclerometer of N-type.	2
<b>L7</b>	Solving problems applying in design of concrete composition, prediction of hardened concrete properties and concrete strength classification.	2

Lecture		
No.	Subject matter of the course Detailed description of thematic blocks	No. of class hours
<b>L1</b>	Introduction to ordinary concrete. Basic terms, components, definitions and classifications. Concrete application. Special types of concrete.	2
<b>L2</b>	Portland cement: production outline, oxide and mineralogical composition of cement clinker. General survey of common cements. Basic information on cement setting and hardening process. Cement paste and water/cement ratio. The role of cement paste in modeling of basic concrete properties.	2
<b>L3</b>	Aggregate and its role in concrete. Classification, basic properties and requirements. Relationship between voids content, specific surface and cement paste demand.	2
<b>L4</b>	Water for concrete, its classification and role in concrete mixture. Consistence condition. Chemical admixtures for concrete and their general classification. Fresh concrete and its basic properties. Tightness condition.	2
<b>L5</b>	Hardened concrete: definition, general characteristic, role in structural members, structure, types of properties.	1

Lecture		
No.	Subject matter of the course Detailed description of thematic blocks	No. of class hours
<b>L6</b>	Mechanical properties of hardened concrete: Compressive strength: classification, conformity criteria, formulas. The other mechanical properties: tensile strength; modulus of elasticity, creep. Factors affecting mechanical properties of concrete. Concrete deformability under load.	2
<b>L7</b>	Physical properties of hardened concrete: density, volume changes of unhardened concrete (thermal expansion and contraction, drying and autogenous shrinkage, swelling). Durability: definition, working life, types of detrimental actions, factors determining durability, exposure classes, requirements concerning concrete composition and properties.	2
<b>L8</b>	Basic technological processes (mixing, delivery, placing, compaction and curing) and their influence on quality of concrete in a member or a structure.	2

Class exercise		
No.	Subject matter of the course Detailed description of thematic blocks	No. of class hours
<b>C1</b>	Common cements. Types of cements, their application fields, classification, basic properties and their testing.	2
<b>C2</b>	Aggregates for concrete. Classification, types of tests, test methods for basic properties, methods of optimal aggregate selection for concrete.	2
<b>C3</b>	Concrete mixture. Basic properties and their test methods. Practical method of designing concrete composition.	2
<b>C4</b>	Chemical admixtures and mineral additives for concrete. Basic types, effects and fields of application.	2
<b>C5</b>	Designing concrete composition by analytical methods: of sand point, of covering of coarse aggregate particles with mortar, of overfilling voids of coarse aggregate particles with mortar.	3
<b>C6</b>	Testing properties of hardened concrete. Testing mechanical properties: compressive strength, tensile splitting strength, flexural strength. Rules for determination of concrete compressive strength class. Testing physical properties: density, water absorption, depth of penetration of water under pressure, freeze/thaw resistance.	2
<b>C7</b>	Destructive, semi-destructive and non-destructive methods of testing concrete in an element or construction.	2

## 7 TEACHING TOOLS

N1 Lectures

N2 Multimedia presentations

N3 Laboratory classes

N4 Work in groups

N5 Table tasks

N6 Consultations

## 8 Student workload

Activity form	Number of hours of activity
<b>Hours realized in contact with the teacher</b>	
Hours resulting from the study plan	45
Consultation hours	6
Exams and tests during session	6
<b>Hours of autonomous student work</b>	
Preparing for classes, studying literature	12
Developing results	9
Preparing of reports, projects presentations, discussion	12
<b>Total number of hours devoted to the subject</b>	<b>90</b>
Total number of ECTS points	3.00

## 9 Methods of grading

To obtain a positive grade in the subject a student should achieve all learning effects specified for the subject, with at least the criteria for grade 3.0 being met.

### Partial grades

F1 Written test on the material delivered in lectures

F2 Written test on the material delivered in tutorials and laboratories

F3 Oral defence of the individual project

### Summary grade

P1 Weighted average of forming grades ((F1 - 0,5; F2 - 0,3; F3 - 0,2)

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### **Conditions for passing the course**

**L1** Getting credits for all forms of classes.

**L2** Participation in tutorials and laboratory classesies. One unjustified absence in each form of classes is accepted.