

# POLITECHNIKA KRAKOWSKA IM. TADEUSZA KOŚCIUSZKI

## KARTA PRZEDMIOTU

obowiązuje studentów rozpoczynających studia w roku akademickim 2019/2020

Wydział Inżynierii Lądowej

Kierunek studiów: Budownictwo

Profil: Ogólnoakademicki

Forma studiów: stacjonarne

Kod kierunku: BUD

Stopień studiów: I

Specjalności: Bez specjalności - studia w języku angielskim

### 1 INFORMACJE O PRZEDMIOCIE

|                                         |                        |
|-----------------------------------------|------------------------|
| NAZWA PRZEDMIOTU                        | Technologia betonu     |
| NAZWA PRZEDMIOTU<br>W JĘZYKU ANGIELSKIM | Technology of Concrete |
| KOD PRZEDMIOTU                          | WIL BUD oIS C23 19/20  |
| KATEGORIA PRZEDMIOTU                    | Przedmioty kierunkowe  |
| LICZBA PUNKTÓW ECTS                     | 3.00                   |
| SEMESTRY                                | 3                      |

### 2 RODZAJ ZAJĘĆ, LICZBA GODZIN W PLANIE STUDIÓW

| SEMESTR | WYKŁAD | ĆWICZENIA<br>AUDYTORYJNE | LABORATORIA | LABORATORIA<br>KOMPUTERO-<br>WE | PROJEKTY | SEMINARIUM |
|---------|--------|--------------------------|-------------|---------------------------------|----------|------------|
| 3       | 15     | 15                       | 15          | 0                               | 0        | 0          |

### 3 CELE PRZEDMIOTU

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

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

**Cel 3** TO FAMILIARIZE STUDENTS WITH RULES OF DESIGNING OF CONCRETE MIXTURE COMPOSITION AND MEASUREMENTS OF ITS BASIC PROPERTIES.

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

**Cel 5** TO FAMILIARIZE STUDENTS WITH BASIC TECHNOLOGICAL PROCESSES AND THEIR INFLUENCE ON FINAL PROPERTIES OF CONCRETE IN A MEMBER OR A STRUCTURE

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

## 4 WYMAGANIA WSTĘPNE W ZAKRESIE WIEDZY, UMIEJĘTNOŚCI I INNYCH KOMPETENCJI

1 BASIC KNOWLEDGE ON CHEMISTRY AND PROPERTIES OF MINERAL BINDERS

2 BASIC KNOWLEDGE ON STRENGTH OF MATERIALS

## 5 EFEKTY KSZTAŁCENIA

**EK1 Wiedza** A STUDENT KNOWS BASIC GROUPS OF CONSTITUENTS MATERIALS OF ORDINARY CONCRETE AND THEIR GENERAL ROLE IN THE CONCRETE.

**EK2 Wiedza** A STUDENT KNOWS BASIC PROCESSES OCCURRING IN CEMENT PASTE.

**EK3 Wiedza** A STUDENT KNOWS BASIC RELATIONSHIPS BETWEEN CONCRETE COMPOSITION AND PROPERTIES OF FRESH AND HARDENED CONCRETE.

**EK4 Wiedza** A STUDENT KNOWS BASIC PROPERTIES OF HARDENED CONCRETE

**EK5 Wiedza** A STUDENT KNOWS BASIC TECHNOLOGICAL PROCESSES AND CAN EXPLAIN THEIR INFLUENCE ON QUALITY OF HARDENED CONCRETE.

**EK6 Umiejętności** A STUDENT CAN DESIGN COMPOSITION OF ORDINARY CONCRETE OF ASSUMED PROPERTIES.

**EK7 Umiejętności** A STUDENT CAN CARRY OUT LABORATORY TESTS OF BASIC PROPERTIES OF CONCRETE CONSTITUENT MATERIALS, FRESH AND HARDENED CONCRETE.

**EK8 Kompetencje społeczne** A STUDENT CAN WORK INDIVIDUALLY AND COOPERATE IN A TEAM ON AN ASSIGNED TASK.

## 6 TREŚCI PROGRAMOWE

| ĆWICZENIA AUDYTORYJNE |                                                                                                                                                  |                  |
|-----------------------|--------------------------------------------------------------------------------------------------------------------------------------------------|------------------|
| LP                    | TEMATYKA ZAJĘĆ<br>OPIS SZCZEGÓŁOWY BLOKÓW TEMATYCZNYCH                                                                                           | LICZBA<br>GODZIN |
| C1                    | Common cements. Types of cements, their application fields, classification, basic properties and their testing.                                  | 2                |
| C2                    | Aggregates for concrete. Classification, types of tests, test methods for basic properties, methods of optimal aggregate selection for concrete. | 2                |
| C3                    | Concrete mixture. Basic properties and their test methods. Practical method of designing concrete composition.                                   | 2                |

| ĆWICZENIA AUDYTORYJNE |                                                                                                                                                                                                                                                                                                                                            |                  |
|-----------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------|
| LP                    | TEMATYKA ZAJĘĆ<br>OPIS SZCZEGÓŁOWY BLOKÓW TEMATYCZNYCH                                                                                                                                                                                                                                                                                     | LICZBA<br>GODZIN |
| <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>             | Aim and methods of concrete curing. Basic information on strength testing methods of concrete in a structure.                                                                                                                                                                                                                              | 2                |

| WYKŁAD    |                                                                                                                                                                                                                                                                                                                                                         |                  |
|-----------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------|
| LP        | TEMATYKA ZAJĘĆ<br>OPIS SZCZEGÓŁOWY BLOKÓW TEMATYCZNYCH                                                                                                                                                                                                                                                                                                  | LICZBA<br>GODZIN |
| <b>W1</b> | Introduction to ordinary concrete. Basic terms, components, definitions and classifications. Concrete application. Special types of concrete.                                                                                                                                                                                                           | 2                |
| <b>W2</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>W3</b> | Aggregate and its role in concrete. Classification, basic properties and requirements. Relationship between voids content, specific surface and cement paste demand.                                                                                                                                                                                    | 2                |
| <b>W4</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>W5</b> | Hardened concrete: definition, general characteristic, role in structural members, structure, types of properties.                                                                                                                                                                                                                                      | 1                |
| <b>W6</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>W7</b> | Physical properties of hardened concrete: density, volume changes of unload 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                |

| WYKŁAD    |                                                                                                                                                         |                  |
|-----------|---------------------------------------------------------------------------------------------------------------------------------------------------------|------------------|
| LP        | TEMATYKA ZAJĘĆ<br>OPIS SZCZEGÓŁOWY BLOKÓW TEMATYCZNYCH                                                                                                  | LICZBA<br>GODZIN |
| <b>W8</b> | Basic technological processes (mixing, delivery, placing, compaction and curing) and their influence on quality of concrete in a member or a structure. | 2                |

| LABORATORIA |                                                                                                                                                                                                                                                                                         |                  |
|-------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------|
| LP          | TEMATYKA ZAJĘĆ<br>OPIS SZCZEGÓŁOWY BLOKÓW TEMATYCZNYCH                                                                                                                                                                                                                                  | LICZBA<br>GODZIN |
| <b>L1</b>   | 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                |
| <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 waterpermeability 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                |

## 7 NARZĘDZIA DYDAKTYCZNE

**N1** Wykłady

**N2** Prezentacje multimedialne

**N3** Ćwiczenia laboratoryjne

**N4** Praca w grupach

**N5** Zadania tablicowe

**N6** Konsultacje

## 8 OBCIĄŻENIE PRACĄ STUDENTA

| FORMA AKTYWNOŚCI                                                                                 | ŚREDNIA LICZBA GODZIN<br>NA ZREALIZOWANIE<br>AKTYWNOŚCI |
|--------------------------------------------------------------------------------------------------|---------------------------------------------------------|
| <b>Godziny kontaktowe z nauczycielem akademickim, w tym:</b>                                     |                                                         |
| Godziny wynikające z planu studiów                                                               | 45                                                      |
| Konsultacje przedmiotowe                                                                         | 6                                                       |
| Egzaminy i zaliczenia w sesji                                                                    | 6                                                       |
| <b>Godziny bez udziału nauczyciela akademickiego wynikające z nakładu pracy studenta, w tym:</b> |                                                         |
| Przygotowanie się do zajęć, w tym studiowanie zalecanej literatury                               | 12                                                      |
| Opracowanie wyników                                                                              | 9                                                       |
| Przygotowanie raportu, projektu, prezentacji, dyskusji                                           | 12                                                      |
| <b>SUMARYCZNA LICZBA GODZIN DLA PRZEDMIOTU WYNIKAJĄCA Z<br/>CAŁEGO NAKŁADU PRACY STUDENTA</b>    | <b>90</b>                                               |
| SUMARYCZNA LICZBA PUNKTÓW ECTS DLA PRZEDMIOTU                                                    | 3.00                                                    |

## 9 SPOSOBY OCENY

### OCENA FORMUJĄCA

**F1** Test

**F2** Projekt indywidualny

**F3** Kolokwium

### OCENA PODSUMOWUJĄCA

**P1** Średnia ważona ocen formujących

### WARUNKI ZALICZENIA PRZEDMIOTU

**W1** wagi do oceny podsumowującej (F1 - 0,3; F2 - 0,2; F3 - 0,5)

### KRYTERIA OCENY

| EFEKT KSZTAŁCENIA 1 |                                                                                                                     |
|---------------------|---------------------------------------------------------------------------------------------------------------------|
| NA OCENĘ 2.0        | A STUDENT KNOWS NEITHER BASIC GROUPS OF CONSTITUENT MATERIALS FOR ORDINARY CONCRETE NOR THEIR ROLE IN THE CONCRETE. |

|                     |                                                                                                                                                        |
|---------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------|
| NA OCENĘ 3.0        | A STUDENT CAN SPECIFY BASIC GROUPS OF CONSTITUENT MATERIALS FOR ORDINARY CONCRETE AND THEIR GENERAL ROLE IN THE CONCRETE.                              |
| NA OCENĘ 3.5        | x                                                                                                                                                      |
| NA OCENĘ 4.0        | x                                                                                                                                                      |
| NA OCENĘ 4.5        | x                                                                                                                                                      |
| NA OCENĘ 5.0        | x                                                                                                                                                      |
| EFEKT KSZTAŁCENIA 2 |                                                                                                                                                        |
| NA OCENĘ 2.0        | A STUDENT DOES NOT KNOW BASIC PROCESSES OCCURING IN CEMENT PASTE.                                                                                      |
| NA OCENĘ 3.0        | A STUDENT CAN SPECIFY BASIC PROCESSES OCCURING IN CEMENT PASTE.                                                                                        |
| NA OCENĘ 3.5        | x                                                                                                                                                      |
| NA OCENĘ 4.0        | x                                                                                                                                                      |
| NA OCENĘ 4.5        | x                                                                                                                                                      |
| NA OCENĘ 5.0        | x                                                                                                                                                      |
| EFEKT KSZTAŁCENIA 3 |                                                                                                                                                        |
| NA OCENĘ 2.0        | A STUDENT CAN SPECIFY BASIC RELATIONSHIPS BETWEEN FRESH AND HARDENED CONCRETE PROPERTIES AND ITS COMPOSITION AND POINT WHAT THEY CAN BE USED FOR.      |
| NA OCENĘ 3.0        | A STUDENT KNOWS BASIC RELATIONSHIPS BETWEEN FRESH AND HARDENED CONCRETE PROPERTIES AND ITS COMPOSITION AND CAN EXPLAIN THEIR MEANING AND SIGNIFICANCE. |
| NA OCENĘ 3.5        | x                                                                                                                                                      |
| NA OCENĘ 4.0        | x                                                                                                                                                      |
| NA OCENĘ 4.5        | x                                                                                                                                                      |
| NA OCENĘ 5.0        | x                                                                                                                                                      |
| EFEKT KSZTAŁCENIA 4 |                                                                                                                                                        |
| NA OCENĘ 2.0        | A STUDENT DOES NOT KNOW BASIC PROPERTIES OF HARDENED CONCRETE.                                                                                         |
| NA OCENĘ 3.0        | A STUDENT CAN SPECIFY BASIC PROPERTIES OF HARDENED CONCRETE AND DESCRIBE TESTING METHODS FOR SOME OF THEM.                                             |
| NA OCENĘ 3.5        | x                                                                                                                                                      |
| NA OCENĘ 4.0        | x                                                                                                                                                      |

|                     |                                                                                                                                                                                                                                          |
|---------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| NA OCENĘ 4.5        | x                                                                                                                                                                                                                                        |
| NA OCENĘ 5.0        | x                                                                                                                                                                                                                                        |
| EFEKT KSZTAŁCENIA 5 |                                                                                                                                                                                                                                          |
| NA OCENĘ 2.0        | A STUDENT DOES NOT KNOW BASIC TECHNOLOGICAL PROCESSES.                                                                                                                                                                                   |
| NA OCENĘ 3.0        | A STUDENT CAN SPECIFY BASIC TECHNOLOGICAL PROCESSES AND EXPLAIN THEIR GENERAL INFLUENCE ON QUALITY OF HARDENED CONCRETE.                                                                                                                 |
| NA OCENĘ 3.5        | x                                                                                                                                                                                                                                        |
| NA OCENĘ 4.0        | x                                                                                                                                                                                                                                        |
| NA OCENĘ 4.5        | x                                                                                                                                                                                                                                        |
| NA OCENĘ 5.0        | x                                                                                                                                                                                                                                        |
| EFEKT KSZTAŁCENIA 6 |                                                                                                                                                                                                                                          |
| NA OCENĘ 2.0        | A STUDENT CAN NOT DESIGN COMPOSITION OF ORDINARY CONCRETE OF SPECIFIED PROPERTIES.                                                                                                                                                       |
| NA OCENĘ 3.0        | A STUDENT KNOWS GENERAL RULES OF DESIGNING COMPOSITION OF ORDINARY CONCRETE OF SPECIFIED PROPERTIES BY BOTH METHODS: PRACTICAL AND ANALYTICAL. NEVERTHELESS SHE/HE CAN NOT SPECIFY PARTICULAR DESIGNING STAGES IN METHODS OF BOTH TYPES. |
| NA OCENĘ 3.5        | x                                                                                                                                                                                                                                        |
| NA OCENĘ 4.0        | x                                                                                                                                                                                                                                        |
| NA OCENĘ 4.5        | x                                                                                                                                                                                                                                        |
| NA OCENĘ 5.0        | x                                                                                                                                                                                                                                        |
| EFEKT KSZTAŁCENIA 7 |                                                                                                                                                                                                                                          |
| NA OCENĘ 2.0        | A STUDENT CAN NOT CARRY OUT LABORATORY TESTS OF BASIC PROPERTIES OF CONCRETE CONTITUENT MATERIALS, FRESH AND HARDENED CONCRETE.                                                                                                          |
| NA OCENĘ 3.0        | A STUDENT CAN CARRY OUT LABORATORY TESTS OF SOME BASIC PROPERTIES OF CONCRETE CONTITUENT MATERIALS, FRESH AND HARDENED CONCRETE. NEVERTHELESS SHE/HE HAS PROBLEMS WITH INTERPRETATION OF OBTAINED RESULTS.                               |
| NA OCENĘ 3.5        | x                                                                                                                                                                                                                                        |
| NA OCENĘ 4.0        | x                                                                                                                                                                                                                                        |
| NA OCENĘ 4.5        | x                                                                                                                                                                                                                                        |
| NA OCENĘ 5.0        | x                                                                                                                                                                                                                                        |

| EFEKT KSZTAŁCENIA 8 |                                                                                                                                            |
|---------------------|--------------------------------------------------------------------------------------------------------------------------------------------|
| NA OCENĘ 2.0        | A STUDENT DOES NOT ENGAGE IN WORKS OF A TEAM.                                                                                              |
| NA OCENĘ 3.0        | A STUDENT EXECUTES A PART OF TASK ASSIGNED FOR A TEAM. NEVERTHELESS SHE/HE NEITHER CONSULTATE NOR VERIFICATE OBTAINED RESULTS WITH A TEAM. |
| NA OCENĘ 3.5        | x                                                                                                                                          |
| NA OCENĘ 4.0        | x                                                                                                                                          |
| NA OCENĘ 4.5        | x                                                                                                                                          |
| NA OCENĘ 5.0        | x                                                                                                                                          |

## 10 MACIERZ REALIZACJI PRZEDMIOTU

| EFEKT KSZTAŁCENIA | ODNIESIENIE DANEGO EFEKTU DO SZCZEGÓŁOWYCH EFEKTÓW ZDEFINIOWANYCH DLA PROGRAMU | CELE PRZEDMIOTU | TREŚCI PROGRAMOWE                      | NARZĘDZIA DYDAKTYCZNE | SPOSOBY OCENY |
|-------------------|--------------------------------------------------------------------------------|-----------------|----------------------------------------|-----------------------|---------------|
| EK1               |                                                                                | Cel 1           | c1 c2 c4 w1 w3 w4 w5 l1 l2             | N1 N2 N3 N4 N5 N6     | F1 F3 P1      |
| EK2               |                                                                                | Cel 2           | c1 w3 l1                               | N1 N2 N3 N4 N5 N6     | F1 F3 P1      |
| EK3               |                                                                                | Cel 3           | c3 c5 w3 w4 w5 w6 w7 l3 l4 l7          | N1 N2 N3 N4 N5 N6     | F1 F2 F3 P1   |
| EK4               |                                                                                | Cel 4           | c6 w2 w6 l5 l6 l7                      | N1 N2 N3 N4 N5 N6     | F1 F3 P1      |
| EK5               |                                                                                | Cel 5           | c3 c7 w8 l3                            | N1 N2 N3 N4 N5 N6     | F1 F3 P1      |
| EK6               |                                                                                | Cel 3           | c3 c5 w2 w7 l2 l3 l4 l7                | N1 N2 N3 N4 N5 N6     | F1 F2 F3 P1   |
| EK7               |                                                                                | Cel 4           | c1 c2 c3 c6 w3 w4 w5 w6 l1 l2 l3 l5 l6 | N2 N3 N4              | F1 F3 P1      |
| EK8               |                                                                                | Cel 6           | l1 l2 l3 l4 l5 l6 l7                   | N3 N4 N5              | F1 F3 P1      |



## 11 WYKAZ LITERATURY

### LITERATURA PODSTAWOWA

- [1] | Neville A.M. — *Properties of concrete*, Londyn, 2011, Longman
- [2] | Newman J., Choo B.S. — *Advanced Concrete Technology*, Elsevire, 2007, Elsevire
- [3] | Jamróży Z. — *Beton i jego technologie*, Kraków, 2005, PWN
- [4] | Śliwiński J. — *Beton zwykły - Projektowanie i podstawowe właściwości*, Kraków, 1999, Polski Cement
- [5] | Mehta K., Monteiro P. — *Concrete: Microstructure, Properties and Materials*, New York, 2013, McGraw Hill Education

### LITERATURA UZUPEŁNIAJĄCA

- [1] | Brandt A.M. — *Cement-based composites*, Routledge, 2009, Routledge
- [2] | Kurdowski W. — *Cement and Concrete*, Miejscowość, 2014, Springer

### LITERATURA DODATKOWA

- [1] | Standards: EN 206; EN 196; EN 197; EN 12350; EN 12390; EN 13670; EN 12620; EN 13577; EN 934.
- [2] | Magazines and Journals: in English: Cement and Concrete Research; Cement and Concrete Composites; Materials and Structures; ACI Materials Journal; Concrete International; Magazine of Concrete Research, etc.in Polish: Cement-Wapno-Beton (also in English); Budownictwo-Technologie- Architektura; Przegląd Budowlany; Materiały Budowlane; Inżynieria i Budownictwo; Archiwum Inżynierii Lądowej (also in English).
- [3] | Conferences Proceedings: Krynica; Matbud; Dni Betonu; Kontra

## 12 INFORMACJE O NAUCZYCIELACH AKADEMICKICH

### OSOBA ODPOWIEDZIALNA ZA KARTĘ

dr hab. inż. prof. PK Lucyna Domagała (kontakt: ldomagala@pk.edu.pl)

### OSOBY PROWADZĄCE PRZEDMIOT

1 dr hab. inż. Lucyna Domagała (kontakt: ldomagala@pk.edu.pl)

2 dr inż. Maciej Urban (kontakt: maurban@pk.edu.pl)

## 13 ZATWIERDZENIE KARTY PRZEDMIOTU DO REALIZACJI

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(miejscowość, data)

(odpowiedzialny za przedmiot)

(dziekan)

PRZYJMUJĘ DO REALIZACJI (data i podpisy osób prowadzących przedmiot)

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