# COURSE DESCRIPTION CARD - SYLLABUS

Course name
Concrete Structures II (with elements of BIM)

## Course

Field of study
Sustainable Building Engineering

Year/Semester
3/6

Area of study (specialization)
-

Profile of study
general academic

Level of study
First-cycle studies

Course offered in
English

Form of study
full-time

Requirements
compulsory

## Number of hours

| Lecture | Laboratory classes | Other (e.g. online) |
|---|---|---|
| 30 | 15 | 0 |
| Tutorials | Projects/seminars | |
| 15 | 0 | |

## Number of credit points

4

## Lecturers

Responsible for the course/lecturer:
prof. dr hab. inż. Mieczysław Kuczma

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Faculty of Civil Engineering and Transport

Institute of Building Engineering

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Responsible for the course/lecturer:
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## Prerequisites

KNOWLEDGE: Student has completed the course on Concrete Structures I and knows principles and rules of analysis and design of simple structural elements (bars, beams, columns) made from concrete concerning their dimensioning and reinforcing. Student has basic knowledge on mathematics, physics, chemistry, technology of concrete, strength of materials and structural mechanics within the scope of courses tought in technical universities; he/she knows the principles of projection geometry and

technical drawing and is capable of reading and preparing typical engineering drawings for buildings by making use of the CAD system.

SKILLS: Student is capable of performing the analysis, design and detailing of basic concrete reinforced structural elements of a building or industrial unit; he/she is able to define and collect loads on structures and to operate basic computer programs for structural analysis and to make use of available sources of information.

SOCIAL COMPETENCE: Student is a responssible person willing to broaden her/his knowledge and to communicate and work in a team environment with her/his colleagues.

## Course objective

To lay the foundation of a thorough understanding of concrete response and derivation of concrete models used in structural analysis and design of reinforced concrete structures.

To teach the fundamental principles of analysis and design, dimensioning and reinforcing of RC cross sections and reinforced concrete plates, building floor system, and frames subjected to bending, shearing, and eccentric action of loads.

## Course-related learning outcomes

### Knowledge

Student will gain an understanding of mechanical and technological problems in reinforced concrete structures and their impact on the safety and security of people and on the environment, and will be able to get acquainted with relevant parts of Polish standards (PN) and European standards (EN).

### Skills

Student is capable of performing the analysis, design and detailing of advanced concrete reinforced structural elements of a building or industrial unit.

### Social competences

Student is aware of the need for acting in the public interest and with regard to the purposes of sustainable building engineering and of her/his respossiblity for the results of performed calculations and design of structural elements.

## Methods for verifying learning outcomes and assessment criteria

Learning outcomes presented above are verified as follows:

Lecture – Final test at the last lecture (2 h)

Laboratory – Two tests, each of 1 h duration

Projects – Completion of a project of a reinforced concrete building floor system and defence of it in the form of test (1 h) at the last meeting.

## Programme content

Introduction, motivation, scope. One-way reinforced concrete plates (slabs). Two-way column-supported reinforced concrete slabs with beams. Design of a beam-and-girder floor. Analytical rules of

design of slab reinforcement, calculation of slab deflections. General rules of computational analysis of structures by means of the Finite Element Method and using of computer programs for structural analysis. Finite elements for bars, beams, disks and plates. Reinforced concrete continuous beams - static analysis and design. Reinforced concrete continuous slabs - static analysis and design. Reinforced concrete disks, walls, and stairs - computation and design. Calculation rules for deflection and cracking in concrete structures. Verification of the serviceablitity, durability and stability requirements. Strut-and-Tie method of design. Monolithic reinforced concrete frames - static analysis, design of joints. Reinforced concrete column design. Foundations: pad footings, combined footings, strip footings - static analysis and design. Retaining walls - static analysis and design.

## Teaching methods

Lecture – Traditional lectures ( "chalk-and-talk"), with computer-assisted presentations at times.

Tutorial – Discussing and solving problems on the blackboard with plenty of student participation.

Projects – Project of a reinforced concrete building floor system.

## Bibliography

Basic

1. Mosley B., Bungey J., Hulse R.: Reinforced concrete design to Eurocode 2. 7th Ed., Palgrave Macmillan 2012
2. Toniolo G., di Prisco M.: Reinforced Concrete Design to Eurocode 2. Springer 2017
3. Nilson A.H., Darwin D., Dolan Ch.W.: Design of Concrete Structures. 15th Ed., McGraw-Hill 2016

Additional

1. EN 1991-1-1 (2002) (English): Eurocode 1: Actions on structures - Part 1-1: General actions - Densities, self-weight, imposed loads for buildings
2. EN 1991-1-3 (2003) (English): Eurocode 1: Actions on structures - Part 1-3: General actions - Snow loads
3. EN 1991-1-4 (2005) (English): Eurocode 1: Actions on structures - Part 1-4: General actions - Wind actions
4. EN 1991-1-5 (2003) (English): Eurocode 1: Actions on structures - Part 1-5: General actions - Thermal actions
5. EN 1991-1-6 (2005) (English): Eurocode 1: Actions on structures - Part 1-6: General actions - Actions during execution
6. EN 1992-1-1 (2004) (English): Eurocode 2: Design of concrete structures - Part 1-1: General rules and rules for buildings
7. Starosolski W.: Konstrukcje żelbetowe według Eurokodu 2 i norm związanych. PWN 2015

8. Knauff M., Golubińska A.: Tablice i wzory do projektowania konstrukcji żelbetowych z przykładami obliczeń. PWN 2013

9. Sekcja Konstrukcji Betonowych KILiW PAN: Podstawy projektowania konstrukcji żelbetowych i sprężonych według Eurokodu 2. Dolnośląskie Wydawnictwo Edukacyjne 2006

10. Grabiec K., Bogucka J., Grabiec-Mizera T.: Obliczanie przekrojów w elementach betonowych i żelbetowych, Arkady 2002

## Breakdown of average student's workload

| | Hours | ECTS |
|---|---|---|
| Total workload | 120 | 4,0 |
| Classes requiring direct contact with the teacher | 65 | 2,0 |
| Student's own work (literature studies, preparation for laboratory classes/tutorials, preparation for tests/exam, project preparation) [1] | 55 | 2,0 |

[1] delete or add other activities as appropriate