COURSE DESCRIPTION CARD - SYLLABUS

Course name
Concrete structures I [S1BZ1E>KB1]

Course

Field of study
Sustainable Building Engineering

Year/Semester
3/5

Area of study (specialization)
–

Profile of study
general academic

Level of study
first-cycle

Course offered in
english

Form of study
full-time

Requirements
compulsory

Number of hours

Lecture
30

Laboratory classes
0

Other (e.g. online)
0

Tutorials
15

Projects/seminars
15

Number of credit points

4,00

Coordinators

prof. dr hab. inż. Mieczysław Kuczma
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Lecturers

Prerequisites

KNOWLEDGE: 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 can transform algebraic expressions and make use of elements of mathematical analysis as well as apply concepts and rules of structural mechanics and strength of materials; 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 RC bars, beams, and columns subjected to tension, bending, shearing, and eccentric compression.

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 basic 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:

Learning outcomes presented above are verified as follows:
Lecture ─ Final test at the last lecture (2 h)
Tutorial ─ Two tests, each of 1 h duration
Projects ─ Completion of 2 projects and their defence in the form of test (1 h) at the last meeting.

Programme content

Introduction, motivation, scope ─ a general review of different types of structures made of unreinforced concrete, reinforced concrete, prestressed concrete, prefabricated concrete elements, steel and concrete composite structures, including beams, frames, walls, plates, shells, silos, tanks, foundations. Principles of structural static analysis and design of structures ─ combination of loads, partial factors of safety, methods for determination of internal forces in RC structures. Role and tasks of the structural engineer. Properties of concrete and reinforcing steel, specificity of their nonlinear behaviour and constitutive relationships and adequate computational models. Bonds and interaction of concrete and steel. Serviceability and durability of concrete structures, exposition class. Bending of reinforced concrete beams. The ultimate limit state (ULS). Determination of the ultimate bending moment capacity, design and detailing of the bending reinforcement of singly and doubly reinforced sections. Shear in beams, principal stresses in beams. Design and detailing of shear reinforcement in beams of rectangular and T sections. Serviceability limit state design: deflection, cracking, durability, fire resistance ─ concepts and determination in beams. Action of axial and eccentric forces on columns. Design and detailing of reinforcement in columns of rectangular and circular sections. Action of concentrated forces on concrete structures ─ crushing and punching shear. Analysis and design of section subject to torsional moments.

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 ─ Two projects: RC beam, and RC cross-section of column.

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 1990 (2002): Eurocode - Basis of structural design
2. EN 1991-1-1 (2002) (English): Eurocode 1: Actions on structures - Part 1-1: General actions - Densities, self-weight, imposed loads for buildings
3. EN 1991-1-3 (2003) (English): Eurocode 1: Actions on structures - Part 1-3: General actions - Snow loads
4. EN 1991-1-4 (2005) (English): Eurocode 1: Actions on structures - Part 1-4: General actions - Wind

actions
5. EN 1992-1-1 (2004) (English): Eurocode 2: Design of concrete structures - Part 1-1: General rules and rules for buildings
6. Starosolski W.: Konstrukcje żelbetowe według Eurokodu 2 i norm związanych. PWN 2015
7. Knauff M., Golubińska A.: Tablice i wzory do projektowania konstrukcji żelbetowych z przykładami obliczeń. PWN 2013
8. Sekcja Konstrukcji Betonowych KILiW PAN: Podstawy projektowania konstrukcji żelbetowych i sprężonych według Eurokodu 2. Dolnośląskie Wydawnictwo Edukacyjne 2006
9. 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	4,00
Classes requiring direct contact with the teacher	65	2,00
Student's own work (literature studies, preparation for laboratory classes/ tutorials, preparation for tests/exam, project preparation)	55	2,00