COURSE DESCRIPTION CARD - SYLLABUS

Course name
Concrete structures [S2Bud1-IPB>KB]

Course

Field of study
Civil Engineering

Year/Semester
1/1

Area of study (specialization)
Construction Engineering and Management

Profile of study
general academic

Level of study
second-cycle

Course offered in
Polish

Form of study
full-time

Requirements
compulsory

Number of hours

Lecture
30

Laboratory classes
0

Other (e.g. online)
0

Tutorials
0

Projects/seminars
30

Number of credit points

3,00

Coordinators

prof. dr hab. inż. Mieczysław Kuczma
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Lecturers

Prerequisites

KNOWLEDGE: The student has knowledge of mathematics, physics and chemistry, knows the rules of analysis, construction and dimensioning of reinforced concrete elements of any building objects and knows the standards and guidelines for designing building objects and their elements. SKILLS: The student is able to evaluate and compile loads acting on building objects, can classify building objects, can design elements in complex reinforced concrete structures, and can choose tools (analytical or numerical) to solve engineering problems. 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

Understanding the principles of analysis and design of shell reinforced concrete structures.

Course-related learning outcomes

Knowledge:
The student knows the rules for determining the combination of permanent and variable loads.
The student knows the rules of dimensioning reinforced concrete sections in a complex load condition.
The student knows the rules of constructing complex reinforced concrete structures.

The student have extended and detailed knowledge of material strength, modelling and constructing; have knowledge of theoretical principles of the finite element method as well as general rules of non-linear calculations of engineering structures

Skills:
The student is able to determine the loads acting on structural systems and determine their most unfavorable cases in combination.
The student is able to design shell structures in the membrane and bending states.
The student is able to construct the reinforcement of selected elements and thin-walled structures.
The student can dimension complex construction details in selected building units.

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
Projects — Completion of a project of a reinforced concrete silo or tank and defence of it in the form of test (1 h) at the last meeting.

Programme content

Analysis of reinforced concrete structures according to Eurocode 2. Types of silos and tanks. Loads acting on silos and tanks and their calculation in combination. Differential equilibrium equations of shells. Surface structures as spherical and conical shells. Cylindrical shells. Liquid tanks. Silos for loose materials. Application of the finite element method and computer programs in the calculation of shell structures. Finite element method. BIM.

Course topics

W1. Types of tanks and their loads
W2. Bulk material tanks
W3. Analysis of structures to Eurocode 2
W4. Liquid containers
W5. Stress tensor, strain tensor, Hooke's law
W6. Differential equilibrium equations for the shells
W7. Solution of structures by the FEM
W8. Interaction of the structure with its soil foundation
W9. Spherical and conical shells
W10. Cylindrical shells – an analytical solution. Boundary effect - the influence of the conditions of fixing the wall in the foundation on the distribution of forces
W11. Solutions of spherical dome on the supporting beam
W12. The concept of BIM (Building Information Modelling)
W13. Examples of BIM applications and computer programs
W14. Execution of tanks
W15. Repair and protection of reinforced concrete tanks

Teaching methods

Lecture — Traditional lectures ("chalk-and-talk"), with computer-assisted presentations.
Projects — Project of a reinforced concrete silo or tank.

Bibliography

Basic
1. K. Grabiec, Żelbetowe konstrukcje cienkościenne. PWN, Warszawa-Poznań 1999.
2. A. Halicka, D. Franczak, Projektowanie zbiorników żelbetowych. Tom 1: Zbiorniki na materiały sypkie.

PWN, Warszawa 2011.
3. A. Halicka, D. Franczak, Projektowanie zbiorników żelbetowych. Tom 2: Zbiorniki na ciecze. Wyd. 2. PWN, Warszawa 2014.
4. M. Knauff i in., Podstawy projektowania konstrukcji żelbetowych i sprężonych według Eurokodu 2. Dolnośląskie Wydawnictwo Edukacyjne, 2006.
5. J. Kobiak, W. Stachurski, Konstrukcje żelbetowe. Arkady, Tom 2 i Tom 4, Warszawa 1987 i 1991.
6. A. Seruga, Sprężone betonowe zbiorniki na ciecze o ścianie z prefabrykowanych elementów. Wyd. Politechniki Krakowskiej, Kraków 2015.
Additional
1. P. Lewiński, Zasady projektowania zbiorników żelbetowych na ciecze z uwzględnieniem wymagań Eurokodu 2: przykłady obliczeń. Wyd. ITB, Warszawa 2011.

Breakdown of average student's workload

	Hours	ECTS
Total workload	90	3,00
Classes requiring direct contact with the teacher	60	2,00
Student's own work (literature studies, preparation for laboratory classes/ tutorials, preparation for tests/exam, project preparation)	30	1,00