SYLLABUS

Name: ***Concrete Structures (BudAB>SI3CONSTR19)***
Name in Polish:
Name in English: ***Concrete Structures***

Information on course:

Course offered by department: Faculty of Civil Engineering
Course for department: Silesian University of Technology

Default type of course examination report:

ZAL

Language:

English

Course homepage:

https://platforma.polsl.pl/rb/course/view.php?id=46

Short description:

The course covers issues related to the basics of designing reinforced concrete elements and structures. It is a continuation of learning about the principles of mechanics used in the design of simple RC elements. Both theoretical and practical aspects related to the activity of structural engineer in the field of construction and building specialty are discussed.

Description:

LECTURES - 30 hours
1. Concrete structures – concept and examples: general idea of concrete and steel use in structural design; types of concrete structures (plain concrete, reinforced concrete, prestressed concrete, composite steel and concrete etc.); brief history of concrete structures; typical structural members made of concrete; structural systems, examples of structures made of concrete, nomenclature related to concrete structures.
2. Properties of concrete and steel: stress and strength of concrete and steel; methods of testing properties of concrete and steel; classes of concrete; classes and grades of steel used in RC; methods of reinforcing concrete (types of reinforcement), deformability of concrete and steel; constitutive relations; concrete strength development with time; concrete and steel properties – advantages and collaboration; cooperation between concrete and steel; bond and anchorage length, concrete – shrinkage and creep.
3. Durability of concrete structures: concrete cover, bars placement in sections, environmental conditions, structural classes, tolerance and deviations for concrete cover with regard to element type.
4. Methods of analysis: static schemes, theoretical support points, simplifications in concrete structures design, ULS versus SLS, possible reasons of the damage of RC element.
5. Sections under flexure: Bernoulli principle, distribution of strain and stress in sections, set of assumptions used in section analysis, methods of design (various distribution of stresses), forces equilibrium conditions, failure modes, reinforcement placement, procedure for finding section capacity, popular section shapes and their design, cooperation between web and flange in T-sections.
6. Members under eccentric compression and tension: second order effects, slenderness, effective length of columns, buckling force modifications introduced in design of RC, braced and unbraced structures, imperfections, interaction between N and M
7. Shear and torsion design; principle stresses in support zone, cracks shape due to shear and torsion, truss model, ultimate forces VRd with regard to inclined tension/ compression, transverse reinforcement, shear resistance for links (stirrups) and bent-up bars.
8. Cracking and deflection control; assumptions in serviceability states control, limitations for crack width and deflection, stress transfer before and after cracking, cracking moment Mcr, strains in concrete and steel and crack spacing, methods of crack width control, tension stiffening, transformed section, creeping of concrete influence on SLS control, flexural stiffness for uncracked and cracked RC members, methods of deflection calculation (constant or variable stiffness).

PROJECT - 20 hours
There are two projects to complete:
Project No 1 – Beam design according to EN 1990, EN 1991 and EN 1992 including static calculations (combination of actions), sections analysis, support zone design for shear, SLS control, beam detailing,
Project No 2 – Column design according to EN 1992 including buckling control, second order effects, sizing sections for bending moments accompanying by axial force.

EXERCISES: 5 hours
Introduction to the issues covered by the projects. As part of the exercises, the lecturers present practical aspects related to the calculation of a reinforced concrete beam and column.

Bibliography:

[1] J.B. Jacobs: Eurocode 2 Commentary, European Concrete Platform ASBL, 2008
[2] B. Mosley, J. Bungey, R. Hulse: Reinforced Concrete Design to Eurocode 2, Palgrave Macmillan, 2007
[3] G. Wandzik: Concrete Structures - teaching materials, 2018.
Normy:
[4] EN 1990:2002 Eurocode: Basis of Structural Design.
[5] EN 1991-1-1: 2001. Eurocode 1: Actions on structures. Part 1-1: General actions. Densities, self-weight, imposed loads for buildings.
[6] EN 1992-1-1:2004. Eurocode 2: Design of concrete structures - Part 1-1: General rules and rules for buildings.

Learning outcomes:

KNOWLEDGE:
(1) Student knows the properties of concrete and steel and understands their impact on the design and calculation of reinforced concrete structures - [course effect K1A_W05].
(2) Student knows the physical basis for determining the load capacity of reinforced concrete elements or cross-sections under the action of systems of internal forces, such as: bending moment, shear force, eccentric compression and tension - [cours effect K1A_W05].
(3) Student understand the principles of standards use in design of RC structures - [course effect K1A_W06].

SKILLS:
(4) Student has the ability to defione the load statement and create combinations of actions used in ULS and SLS control - [course effect K1A_U02].

(5) Student is able to determine the load capacity under the action of internal forces (N, M, V) for simple reinforced concrete elements, such as: slabs, beams, columns, walls - [course effect K1A_U04].

K1A_U04: Student has an ability of sizing selected simple structural RC elements such as: slabs, beams, columns, walls.

Assessment methods and assessment criteria:

PRELIMINARY REQUIREMENTS:
No preliminary requirements

REQUIREMENTS:
(1) Active presence in project classes and exercises.
(2) Completion (with understanding) of two PROJECTS.
(3) Passing the colloquium covers topics discussed during lectures and exercises.

FINAL ASSESSMENT:
60% (colloquium), 40% (projects).

POSSIBILITY OF TRANSFERRING GRADES:
To transfer partial grades, students should contact the lecturer within the first two weeks of the semester.

The syllabus is valid from the winter semester of the 2025/2026 academic year, and its content is not subject to change during the semester.

Element of course groups in various terms:

Course group description	First term	Last term
missing group description in English (BudAB-S1-2019-sem3)	2020/2021-Z	

Course credits in various terms:

<without a specific program>

Type of credits	Number	First term	Last term
European Credit Transfer System (ECTS)	4	2020/2021-Z	