Tadeusz Kosciuszko Cracow University of Technology

Course Card

Faculty of Civil Engineering

Field of study: Civil Engineering — Study profile: general academic

Study form: full-time — Field of study code: BUD

Study cycle: 1st

Specialty: no specialty

1 COURSE INFORMATION

Course name	Konstrukcje betonowe
Course name in English	Concrete Structures
Course code	WIL BUD oIS C41 24/25
Course category	Basic
No. of ECTS points	7.00
Semester	5 and 6

2 CLASS TYPE, NUMBER OF HOURS ACCORDING TO THE STUDY PLAN

Semester	Lecture	Class exercise	Laboratory	Computer lab	Design exercise	Seminar
5	30	0	0	0	30	0
6	15	0	15	0	15	0

3 COURSE OBJECTIVES

Objective 1 Cognition of mechanical characteristics for concrete and reinforcing steel, understanding the conditions of their co-operation in reinforced concrete structures and basic requirements formulated for such structures

Objective 2 Recognition of codes principles and methods for safety, durability and serviceability assurance in the design process

Objective 3 Learning the basis of reinforced concrete structures design according to Limit States Method within the range of: bending, shear, compression, tension, punching shear, together with appropriate codes regulations. Recognition of principles for Ultimate Limit States verification

Objective 4 Recognition of Serviceability Limit States and simplified methods of crack width and deflection verification

Objective 5 Cognition of phenomena connected with slenderness and second order effects and their consideration in reinforced concrete compressed members design

Objective 6 Getting familiar with the methodology of simple laboratory tests and the course of actions taken while testing on the example of reinforced and prestressed concrete beams

Objective 7 Mastering the basis of reinforced concrete elements detailing and working out the structural drawings

Objective 8 Shaping the professional responsibility of structural engineer

4 PREREQUISITES IN TERMS OF KNOWLEDGE, SKILLS AND OTHER COMPETENCES

1 Passing preceding subjects. For semester V: Theoretical mechanics, Technical drawings, Engineering graphics, Building materials, Concrete technology, Strength of materials, Mechanics of structures. b. Passing preceding subjects. For semester VI: Theoretical mechanics, Technical drawings, Engineering graphics, Building materials, Concrete technology, Strength of materials, Mechanics of structures, Concrete structures (semester V).

2 Passing preceding subjects. For semester VI: Theoretical mechanics, Technical drawings, Engineering graphics, Building materials, Concrete technology, Strength of materials, Mechanics of structures, Concrete structures (semester V).

5 LEARNING OUTCOMES

LO1 Knowledge Student knows mechanical characteristics and material models used for reinforced concrete structures, basic rules of materials co-operation and questions of bond between concrete and reinforcing steel

LO2 Skills Student can apply basic rules and methods of safety, serviceability and durability assurance within the design process for reinforced concrete structures according to appropriate valid codes

LO3 Knowledge Student can select initial dimensions of rc elements, set the appropriate actions and combinations of actions, carry out static calculations, verify load-bearing capacity for simple structural elements and produce structural drawings

LO4 Skills Student is able to check Serviceability Limit States for reinforced concrete elements using simplified methods

LO5 Skills Student knows the questions of slenderness and second order effects influence onto behavior of compressed rc elements

LO6 Knowledge Student knows codes detailing rules for the following reinforced concrete elements: slabs, beams, columns, foundation footings, stairs, frames

LO7 Skills Student knows the phases of work and the course of tests conducted for reinforced concrete and prestressed concrete beams, as well as the basic equipment used and measuring techniques applied while conducting laboratory tests

LO8 Social competencies Student is aware of responsibility for structure design correctness and of necessity to improve professional competencies

6 COURSE CONTENT

Lecture		
No.	Subject matter of the course Detailed description of thematic blocks	No. of class hours
L1	Definition and qualification of concrete structures. Basic characteristics for concrete and reinforced concrete structures. Mechanical properties for concrete and reinforcing steel. Requirements for materials. Co-operation between concrete and steel - bond and anchorage.	4
L2	Basic requirements for concrete structures. Limit states method. Criteria for safe and durable concrete structure. Characteristic and design values, safety coefficients.	2
L3	Ultimate limit states (ULS) for bending - phases of work for bent element. Simplified method of verification for ULS according to design assumptions, rectangular and T-beam croos-sections, single- and double-reinforced cross-sections. Designing and checking the capacity of elements under bending. detailing conditions for bent elements	8
L4	ULS for shear. Scheme for shear zone failure, reliable cross-sections for checking the shear capacity. Design conditions for shear. Ultimate values of shear force. Designing and checking capacity for shear. Shear reinforcement between slab and beam. Detailing rules for shear reinforcement (stirrups, bent-up bars)	6
L5	Serviceability limit states (SLS). deflections of rc elements, limit admissible values of deflection, verification of SLS for deflection by simplified method. Cracks in RC structures - crack occurrence, checking crack width with simplified method.	4
L6	Examples of typical structural elements (one-way slabs, beams) - geometry and reinforcement course	6
L7	ULS for compression - eccentrically loaded elements. Buckling, effective length, second order effects, eccentricities, critical load. Methods of design for compressed elements with taking into account the second ordere effects. Designing and checking capacity for cases of big and small eccentricities. Detailing conditions for columns	5
L8	Eccentrically tensiled elements. ULS for tension - equilibrium equations for cross-section.	2
L9	ULS for punching shear - checking the capacity for un-reinforced elements	2
L10	Reinforced concrete monolithical stairs - static behavior and detailing	2
L11	Examples of typical structural elements (two-way slabs, columns, foundation footings, rc frames) - geometry and reinforcement course	4

Design exercise		
No.	Subject matter of the course Detailed description of thematic blocks	No. of class hours

Design exercise		
No.	Subject matter of the course Detailed description of thematic blocks	No. of class hours
P1	Design of slab-beam floor. Static calculations and dimensioning. Design of one-way slab under bending. Design of beam for bending and shear. Checking SLS by simplified methods. Producing structural drawings for slab and beam with taking into account the beam load-bearing envelope.	30
P2	Design of monolithical frame for multi-story building (continuation of theme from semester V). Static calculations for frame. Designing of columns. Designing of foundation footings loaded eccentrically. Structural drawing for columns and footings.	15

Laboratory		
No.	Subject matter of the course Detailed description of thematic blocks	No. of class hours
L1	Laboratory tests for reinforced and prestressed concrete beams	15

7 TEACHING TOOLS

N1 Lecture

N2 Design exercise

N3 Laboratory exercise

N4 Multimedia presentation

N5 Consultation

8 Student workload

Activity form	Number of hours of activity
Hours realized in contact with the teacher	
Hours resulting from the study plan	105
Consultation hours	0
Exams and tests during session	0
Hours of autonomous student work	
Preparing for classes, studying literature	30
Developing results	5
Preparing of reports, projects presentations, discussion	70
Total number of hours devoted to the subject	**210**
Total number of ECTS points	7.00

9 Methods of grading

Partial grades

F1 Individual project

F2 Colloquium

F3 Report on the laboratory exercise

Summary grade

P1 Written exam

P2 Weighted average of the midterm tests grades

Conditions for passing the course

L1 Exam may be taken only by those students who pass design workshops (design part and colloquium) and laboratory workshops

L2 Exam (in writing) include two parts: test and design exercise

L3 Final mark is weighted average from marks from; 1/ design workshops, 2/laboratory workshops, 3/written exam (in semester VI)