Ministry of Education and Science of Ukraine

ODESA STATE ACADEMY OF CIVIL ENGINEERING AND ARCHITECTURE

Civil Engineering Institute
Department of Reinforced Concrete Structures and Transport Facilities

SILABUS
educational component – EC 3
Constructions of Buildings and Structures. Special Course

Educational level	Master's
Field of knowledge	19 Architecture and Construction
Specialty	192 Building and Civil Engineering
Educational program	Industrial and Civil Engineering
Educational component scope	3 **credits ECTS** (90 academic hours)
Types of classroom training	Lectures, practical classes
Individual tasks	Calculated and graphical work
Forms of final (term) control	credit

Lecturer(s):
Oleksandr Gilodo, PhD., Assoc. Professor, Department of Metal, Wooden and Plastic Structures gil@soborka.net
Oleksii Bondarenko, PhD., Assoc. Professor, Department of Reinforced Concrete Structures and Transport Facilities, al_bondarenko@ukr.net

When studying the educational component, higher education students will develop the following skills and competences about the design of long-span, spatial steel and reinforced concrete structures and engineering structures of various purposes.

Requirements for studying the educational component: Building materials, Strength of materials; Construction mechanics; Metal structures, Reinforced concrete structures, Bases and foundations.

Program learning outcomes:
PLO 3. The ability to use regulatory and legal acts in everyday life professional activity; orient yourself in scientific, special literature and laws.
PLO 7. The ability to assess the danger of aggressive influences on construction structures and buildings - atmospheric, chemically and biologically active environments, leakage currents and stray currents, etc., develop and implement measures to protect against them and ensure the necessary durability of structures and buildings.
PLO 8. To use the technical Ukrainian language orally and in writing.
PLO 9. Ability to design structures from modern materials; evaluate work and the stress state of buildings and structures as a whole, its structural elements, redistribution of efforts in connection with the change design scheme; solve the issue of assessment of bearing capacity structures
PLO 12. Ability to perform inspections of the technical condition of buildings, structures and engineering communications, and give an assessment of this state; evaluate them further operational suitability or the need for development the project of restoration of this suitability; calculate the required level increasing the bearing capacity of the structure to provide operational suitability of the building.
PLO 13. Ability to design buildings and structures, including with use computer design software systems based on effective combination of innovative technologies and the implementation of

multivariate calculations of metal structures.
PLO 14. To design constructions of buildings and structures in order to provide its strength, stability, durability and safety, ensuring reliability.
PLO 17. The ability to find optimal solutions when creating individual species construction products taking into account architectural and planning requirements solutions, strength, durability, life safety, quality, cost, terms of execution and competitiveness.

Differentiated program learning outcomes:
to know:
- calculation methodology for designing various building structures made of steel and reinforced concrete for static loads;
- valid regulatory standarts;
- advantages and disadvantages of steel and reinforced concrete in long-span, spatial structures and engineering structures and areas of their effective use.

to possess:
- method of layout of long-span and spatial structures;
- method of layout of high-rise buildings;
- a method of calculating long-span and spatial structures, prestressed beam systems;
- the method of layout of engineering structures and the method of their calculation.

to be able to:
- evaluate the work and stress state of long-span, spatial structures and engineering structures in general, their structural elements;
- using the basic provisions of calculations, evaluate the strength, stiffness and stability of individual elements of structures;
- use a variety of technical and regulatory sourses to solve special problems of calculating and designing building structures and engineering structures.

Thematic plan

Part 1
Topic 1. Field of application, features and classification of long-span structures. Long-span beam structures. Arched and frame long-span structures, their design features, basis of calculation. Impact on steel structures of atmospheric, chemically and biologically active environments, leakage currents and stray currents.
Topic 2. Spatial constructions of coverings: structural coverings, their structural features, basis of calculation. Domes. Types of systems. Basics of calculation. Hanging systems. Properties, types. Peculiarities of loads, materials, design features, calculation methods.
Topic 3. Cabel systems. Properties of long-span suspended coverings. Peculiarities of loads on houses with suspended coverings. Types of cable systems.
Topic 4. Single belt hanging systems. Examples of coverings, the basis of their calculation. Two-belt systems. Covering with saddle-shaped tension nets. Combined hanging systems.
Topic 5. High-rise buildings. Field of application, general characteristics. Towers, masts, supports of power transmission networks.
Topic 6. Sheet structures. Field of application, general characteristics, features, calculation theory. Tanks. Classification. Vertical cylindrical tanks of low pressure.
Topic 7. Tanks of special designs. Vertical cylindrical tanks with a floating roof. Tanks with a pontoon. Vertical cylindrical high pressure tanks. Installation of tanks.
Topic 8. Horizontal cylindrical tanks. Spherical tanks. Gasholders. Constant and variable volume gas holders. Spherical gas holders. Design features. Water towers.

Part 2
Topic 1. Thin-walled spatial structures. Basics of shell theory. Structural features of thin-walled spatial coatings.
Topic 2. Thin-walled spatial structures. Long cylindrical shells. Short cylindrical shells and prismatic folds. Sloping shells of positive Gaussian curvature, rectangular in plan.
Topic 3. Thin-walled spatial structures. Domes (Bathrooms). Wavy vaults.
Topic 4. Thin-walled spatial structures. Hanging coverings.
Topic 5. Design of reinforced concrete structures of engineering structures. Calculation and construction of reinforced concrete structures of tanks. Water towers.
Topic 6. Design of reinforced concrete structures of engineering structures. Design of reinforced concrete

structures of bunkers. Design of reinforced concrete structures of silos.

Topic 7. Design of reinforced concrete structures of engineering structures. Design of retaining walls. Design of underground channels and tunnels. Reinforced concrete exhaust cooling towers. Reinforced concrete chimneys.

Topic 8. Protective structures of civil protection. Classification and field of application.

Score criteria and diagnostic tools

The minimum and maximum score for the «credit» in the educational component «Constructions of Buldings and Structures» ranges from 60 points to 100 points.

The educational component includes the following task – 2 calculated and graphical work:

1. Calculated and graphical work on the topic: "Design of long-span prestressed steel truss" consists of a calculation and explanatory note and a graphic part (drawings). When performing calculation and graphic work, a long-span rafter truss is optimized by prestressing the most tensioned elements.

2. Calculation and graphic work on the topic: "Design of long-span prestressed reinforced concrete truss" consists of a calculation and explanatory note and a graphic part (drawings). When performing calculation and graphic work, a long-span rafter truss is optimized by prestressing the most tensioned elements.

Term control is carried out in the form of credit. The credit score is set on the basis of the results of the current tasks control during the semester.

Information support

Main sources of information

1. DBN V.2.6-198:2014. Steel structures. Design standards. With Change No. 1. K.: Ministry of Regions of Ukraine, 2022
2. DBN V.1.2-2006. Loads and influences. Design standards. With change No. 1 and No. 2. K.: Ministry of Regions of Ukraine, 2020.
3. DBN V.1.2-2006. Loads and influences. Design standards. With the change of No. 1 and No. 2. K.: Ministry of Regions of Ukraine, 2020.
4. Kupchenko Yu.V. Methodical guidelines "Design of prestressed steel rafter farms" / Yu.V. Kupchenko, P.M. Singaivskyi, S.M. Chuchmai, P.V. Konstantinov. Odesa: ODABA. 2020. 69 p.
5. Bondarenko O.V. Methodical recommendations for the implementation of RGR / O.V. Bondarenko, N.V. Pushkar, O.F. Maistrenko//Odesa: ODABA. -2024. 51 p.
6. DBN V 2.6-98:2009 "Concrete and reinforced concrete structures". Basic provisions. // Ministry of Regional Construction of Ukraine, Kyiv. - 2011.
7. DSTU B V.2.6-156:2010 "Concrete and reinforced concrete structures from heavy concrete". Regulations designing. // Ministry of Regional Construction of Ukraine, Kyiv. - 2011.
8. Synopsis of the educational discipline "Reinforced concrete and stone structures. Special course" to lecture classes for students of educational-professional and educational-scientific programs "Industrial and civil construction" / Odesa State Academy of Construction and Architecture / Incl.: O.V. Bondarenko, O.F. Maistrenko, N.V. Pushkar - Odesa, 2023, 103 p.
9. Khomenko O.G. Reinforced concrete structures. Study guide. Gluhiv: 2017. 208 p.

Additional sources of information

10. Nilov O.O. Metal constructions: General course: Textbook for higher education institutions - 2nd edition, revised and supplemented. - K.: "Stal", 2010. 869 p.
11. Barashikov A.Ya. Reinforced concrete structures. Textbook. K.: Higher School, 1995. 592 p.
12. Vakhnenko P.F., Pavlikov A.M., Horyk O.V., Vakhnenko V.P. Reinforced concrete structures. Textbook K.: Higher school, 2000. 508 p.
13. Golyshev O.B., Bambura A.N. "Course of lectures on the basics of calculation of building structures and on the resistance of reinforced concrete", Kyiv, LOTOS, 2004.