Master's Program *Theory and Design of Buildings and Structures*

CORE COURSES

B.1.C.3. Methods for Solving Scientific and Engineering Problems in Civil Engineering

Course Aim

Students will acquire skills of defining a research problem, they will know theoretical concepts and have practical skills of solving various research and scientific and engineering problems.

Course Description

The course is delivered in modules. Students are expected to possess knowledge of defining a research problem, collecting available information and using information technologies. They will be able to formulate research objectives, forecast the results of studies, develop research programs. Students will obtain skills of using information technologies, methods of modeling, different methods of solving problems, processing experimental and theoretical data, the logic of scientific knowledge development and choice of alternative options.

Learning Outcomes (Competences)

On completion of the course students will be able to:

- demonstrate knowledge of the program courses related to fundamental and applied sciences;
- use advanced theoretical and practical knowledge;
- acquire new knowledge and skills independently using information technologies in practice, including new areas of science not directly associated with their profession;
- broaden their scientific world outlook;
- use profound knowledge of legal and ethical norms evaluating the results of their professional activity, developing and implementing socially significant projects;
- understand main problems of the subject area and solve them using quantitative and qualitative methods;
- define a problem, apply knowledge of contemporary research methods, analyze, synthesize and make critical information summary;
- conduct scientific experiments using modern research equipment and devices, evaluate the results of the studies;
- execute, present and report the results of the work done;

Credit hours

Learners are expected to earn 5 credits for doing 108 hours of work.

In-class training: 90 hours, including 36 hours of lectures and 54 hours of practical classes.

Independent work: 90 hours.

Progress Evaluation

Pass/fail exam, 1st semester.

Graded exam, 2nd semester.

B.1.C.4. Information Technologies in Civil Engineering

Course Aim

Students will possess necessary theoretical knowledge and practical skills of applying information technologies in civil engineering.

Course Description

The course is a part of basic professional courses delivered in English. Students are expected to improve skills and knowledge obtained in the previous study of *Information Technologies in Civil Engineering* (Bachelor's level). The course is delivered in modules. Graduates will get knowledge of different universal and specialized software packages for processing scientific and technical information, automated design systems in civil engineering, peculiarities of their application in the design and calculation of complex construction projects and scientific and technical objectives, skills of using information and communication technologies in civil engineering.

Learning Outcomes (Competences)

On completion of the course students will be able to:

- acquire new knowledge and skills using information technologies even in those areas which are not directly associated with their professional activity;
- broaden their scientific world outlook;
- develop preliminary, technical and working projects of complex objects, and use automated design systems for that;
- find, process and analyze information from a variety of sources, use universal and specialized software packages for solving computational problems in the design of buildings and structures.

Graduates will know:

- methods of design and monitoring of buildings and constructions, their structural components including methods of design-basis analysis using universal and specialized software packages and automated design systems.

Credit Hours

Learners are expected to earn 3 credits for doing 108 hours of work.

In-class training: 54 hours, including 18 hours of lectures and 36 hours of practical classes.

Independent work: 54 hours.

Progress Evaluation

Pass/fail exam, 1st semester.

B.1.C.5. Structural Design and Analysis of Buildings

Course aim

Students will understand principles of designing buildings and structures taking into account modern achievements in the field of calculation and design requirements for buildings and structures, theorems and principles of mechanics.

Course Description

The course focuses on requirements for buildings and structures; models of buildings and foundations according to B. A. Garagash's classification; structural systems of buildings and constructions; impact on buildings and structures; exploitation conditions; constructions standardization and certification; design layout, calculations and analysis results; design requirements and layout; features of design and construction in urban development conditions; structural engineering technology; spatial analysis of buildings on non-homogeneous foundations; scientific support of civil engineering.

Learning Outcomes (competences)

On completion of the course students will be able to:

- perform, present and report results of the work done;
- carry out surveys to evaluate natural and technological objects conditions, determine initial data for the design and calculation analysis and monitoring of objects; do patent research, prepare design specifications;
- develop conceptual, technical and working projects of complex objects using CAD.

Graduates will know:

- methods of design and monitoring of buildings and constructions, their structural components, including methods of calculation analysis using universal and specialized software packages and automated design systems.

Credit Hours

Learners are expected to earn 4 credits doing 144 hours of work.

In-class training: 36 hours, including 18 hours of lectures and 18 hours of practical classes.

Progress Evaluation

Exam, 1st semester.

The course assessment includes writing reports and answering questions.

B.1.C.6. Efficiency of Innovations and Innovative Technologies in Civil Engineering

Course Aim

Students will learn modern methods of collecting, processing and analyzing economic data related to innovative technologies in civil engineering; a system of technical and economic indicators to compare design projects; principles of techno-economic analysis of projects and methods for the innovative potential estimation.

Course Description

The course focuses on innovative activity in civil engineering, its basic concepts and peculiarities. The course modules cover such areas as innovative technologies in prefabricated large-panel and monolithic frame house-building; various technologies for frame-panel buildings construction, prefabricated buildings made of lightweight steel thin-walled structures, prefabricated houses of the container type *flatpack*; energy-saving technologies for repair, renovation and restoration of buildings; technologies for information modeling *BIM* (Building Information Modeling) and *Royal Building System* (RBS); technologies for the construction of buildings using building blocks *Smart Brick*, *Hebel blocks*, panels *Demountable Insulated Panels* (DIPS); methods for installation of ballasted roofs, methods for joint-free facade finish; “green” standards in civil

engineering and principles of "green development"; methods for the innovative potential estimation (a method of expert analysis, a method of financial and economic analysis, an analytical method); investment project stages, investment project components analysis for the construction of real estate; calculation of the investment project payback related to buildings reconstruction; technical and economic indicators system to compare options and financial analysis of design projects.

Learning Outcomes (Competences)

On completion of the course students will be able to:

- make a preliminary techno-economic analysis of projects;
- develop estimate documents;
- make an economic analysis of projects effectiveness.

Graduates will know:

- methods for the estimation of the innovative potential of the performed work and its future prospects;
- modern achievements in civil engineering and their use;
- project commercialization risk assessment.

Credit Hours

Learners are expected to earn 3 credits doing 108 hours of work.

In-class training: 54 hours, including 18 hours of lectures and 36 hours of practical classes.

Independent work: 54 hours.

Progress Evaluation

Pass/fail exam, 3rd semester.

ADDITIONAL COURSES

Compulsory Courses

B.1.A.CC.1. Structural Durability and Reliability

Course Aim

The course focuses on theory of reliability, requirements for construction sites, methods of ensuring reliability; structural failure causes, structural durability, methods ensuring the required durability.

Course Description

The course deals with terms and definitions, basic concepts and characteristic of reliability, technical conditions of construction projects, requirements for safety; aspects of safety and risk; methods for limit states calculations of buildings and structures; failures of building elements; structures and systems; safety factors systems. Students will learn how to ensure and control reliability including processes of design, construction and exploitation of buildings and structures; causes of breakdowns; methods of ensuring the required durability; the optimal level of reliability; reliability of coupling elements in parallel and in series; system survivability; the coefficient of mechanical properties variation in materials; random parameters of reliability.

Learning Outcomes (Competences)

On completion of the course students will be able to:

- estimate durability and safety of building structures, bases and foundations;
- identify factors which decrease reliability and durability;
- estimate the residual life of load-bearing building structures;
- select structural materials and forms ensuring the required reliability, safety, economy and efficiency of structures.

Students will know:

- basic probabilistic methods of safety and risk theory needed for the design and analysis of buildings and structures;
- methods of preventing propagating rupture;
- methods of increasing the durability and serviceability of buildings and structures

Credit Hours

Learners are expected to earn 7 credits doing 252 hours of work.

In-class training: 90 hours, including 36 hours of lectures, 18 hours of laboratory work and 36 hours of practical classes.

Progress Evaluation

Exam, 1st and 2nd semesters.

Continuous assessment: reports, interviews, laboratory work.

B.1.A.CC.2 Foundation Engineering in Difficult Soil Conditions

Course Aim

The course focuses on principles of designing foundations for seismic and dynamic loads as well as for specific soil conditions: on collapsible, compressed, saline, swelling, frozen and

permafrost soils.

Course Description

The course deals with the design and analysis of bases and foundations for difficult soil conditions. The course is delivered in modules which cover problems of doing research and designing bases and foundations for poorly saturated, silty, collapsible, unevenly compressed, saline, swelling, permafrost and heaving soils, friable sands and quicksands, karstified land and anthropogenic soils, technogenic, rock and residual soils taking into account seismic and dynamic loads etc. Students will study collapsible soils identifying the type of soil conditions with regard to subsidence, analyzing it and using methods of preventing and decreasing subsidence; technogenic soils and methods of their design with regard to heterogeneity and nonuniform compressibility; embankments, barrows and landfills; poorly saturated soils; methods of designing surcharges, foundation drains; the time-dependent deformation analysis including nonlinear deformation. Graduates will possess knowledge of swelling soils; methods of analyzing swelling deformation and shrinkage; waterproofing and building activities; saline soils; the solution sinkholes analysis; frozen and permafrost soils; principles of foundation engineering; the frost boil analysis; foundations engineering in seismic areas; the analysis of the dynamic loaded machine foundation; ways to reduce low-frequency oscillations.

Learning Outcomes (Competences)

On completion of the course students will be able to:

- use modern methods for diagnostics and monitoring of building constructions relying on experimental methods of determining stress-strain state of structures;
- solve theoretical and constructional problems for the design improvement of buildings and structures;
- design and analyze foundations in difficult engineering-geological and geohydrological conditions.

Graduates will know:

- basic principles for carrying out surveys; methods for engineering, construction and exploitation of buildings in difficult soil conditions;
- methods of foundation engineering.

Credit Hours

Learners are expected to earn 5 credits doing 180 hours of work.

In-class training: 54 hours, including 18 hours of lectures, 36 hours of practical classes.

Independent work: 54 hours.

Progress Evaluation

Exam, 2nd semester.

Coursework, 2nd semester

B.1.A.CC.3. Steel Structures (a specialized course)

Course Aim

The course focuses on calculation principles, design of special metal structures of buildings and constructions for various purposes.

Course Description

Students are expected to improve skills and knowledge obtained in the previous study of *Steel Structures* (Bachelor's level). The course is delivered in four modules. The first module covers problems of sheet metal structures (storage tanks, gas storage vessels, storage bunkers and silos). Students will possess profound knowledge and practical skills needed for writing a course work on the topic *Low pressure vertical cylindrical tank*. The second module deals with basic principles of designing prestressed metal structures (beams, beam constructions, steel trusses). Graduates will study the stress-strain state of structures and methods of its analysis. The third module describes design of steel structures at low and high temperatures, the corrosive medium impact, ways of evaluating cold resistance, examples of design related to cold-resistant structures and structures with high corrosion resistance. The fourth module covers problems of calculation schemes, calculation principles of high-rise towers and masted structures; the design and analysis of steel posts for overhead transmission lines.

Learning Outcomes (Competences)

On completion of the course students will be able to:

- develop preliminary, technical and working projects of facilities, which are subjected to heavy loads and stress, for extreme climatic conditions;
- solve theoretical and constructional problems related to the design improvement of buildings and structures.

Graduates will know:

- methods for optimal design of steel structures;
- types of steel structures corrosion and methods of its prevention;
- methods of designing dynamic loaded steel structures at low and high temperatures.

Credit hours

Learners are expected to earn 5 credits doing 180 hours of work.

In-class training: 54 hours, including 18 hours of lectures and 36 hours of practical classes.

Independent work: 54 hours.

Progress Evaluation

Exam, 2nd semester.

Coursework, 2nd semester.

B.1.A.CC.4. Reinforced Concrete Constructions (a specialized course)

Course Aim

The course focuses on calculation principles, design of special reinforced concrete constructions of buildings for various purposes.

Course Description

Students are expected to improve skills and knowledge obtained in the previous study of *Reinforced-Concrete and Stone Constructions* (Bachelor's level). The course is delivered in four modules. The first module describes channels and tunnels, basements walls, retaining walls, their types, construction requirements, loads, the retaining wall shear strength analysis, the ground deformation and the ground strength analysis, the analysis of forces in wall elements, the material calculation. The second module deals with reinforced-concrete silos, storage bunkers, their types and space planning solutions; granular material pressure on walls and the bottom, the impact of different factors on pressure; calculation principles. The third module covers problems of reinforced-concrete rectangular and cylindrical tanks, their design features, advantages and disadvantages, their analysis with regard to the size and embedment, geohydrological conditions.

The fourth module outlines tower type constructions such as water towers, chimneys, cooling towers, design of structures, foundations and calculation principles. Students will possess profound knowledge and practical skills needed for writing a course work on various types of retaining walls, silos, storage bunkers, underground tanks.

Learning Outcomes (Competences)

On completion of the course students will be able to:

- develop preliminary, technical and working projects of facilities, subjected to heavy loads and stress, for extreme climatic conditions;

Graduates will know:

- methods of designing reinforced-concrete constructions subjected to heavy loads and stress.

Credit Hours

Learners are expected to earn 8 credits doing 288 hours of work.

In-class training: 54 hours, including 18 hours of lectures and 36 hours of practical classes.

Independent work: 72 hours.

Progress Evaluation

Exam, 3rd semester.

Coursework, 3rd semester.

Elective Courses

B.1.A.EC.1.1. Design Software for Structural Design Calculation

Course Aim

The course focuses on modern design software for structural design calculation and its application in structural engineering.

Course Description

Students are expected to improve skills and knowledge obtained in the previous study of *Information Technologies for Structural Design Calculation* (Bachelor's level). The course is delivered in three modules. The first module focuses on theoretical concepts of the finite element method as a main calculation tool, nonlinear problems including physical and geometric nonlinearity, one-way communication, friction, stability, nonlinear dynamics. Students will study methods and techniques of creating computer models including modeling of processes related to the life cycle of structures. The second module deals with the peculiarities of design software *Structure CAD (SCAD)* and its application in structural engineering as an integrated system of strength analysis and structural design. Students will learn how to create design diagrams and graphs to analyze the obtained results; how to use the post-processor (the ultimate limit state calculation and the service limit state calculation of reinforcement for core and plate elements of reinforced-concrete constructions, the bearing capacity testing and proportioning of steel structures members with rolled sections). The third module describes satellite programs SCAD OFFICE such as *Crystal, Arbat, Request, Bush;* design software *STARCON (STARK ES), LIRA-SAPR, Autodesk Robot*.

Learning Outcomes (Competences)

On completion of the course students will be able to:

- use special design software to solve problems of design and calculation;
- create calculation schemes and make a static and dynamic analysis of building structures using modern finite element software systems;

- model the life cycle of building structures and evaluate the accuracy of computer simulation.

Credit Hours

Learners are expected to earn 3 credits doing 108 hours of work.

In-class training: 54 hours, including 54 hours of practical classes.

Independent work: 54 hours.

Progress Evaluation

Pass/fail exam, 3rd semester.

B.1.A.EC.1.2. Automated Systems in Civil Engineering

Course Aim

The course focuses on modern automated systems used in civil engineering and their application in structural engineering.

Course Description

Students are expected to improve skills and knowledge obtained in the previous study of *Information Technologies for Structural Design Calculation* (Bachelor's level). The course is delivered in three modules. The first module analyzes methods of creating modern software systems for the calculation of load-bearing building structures as well as ways to use these systems. Students will learn how to use the finite element method for solving linear and nonlinear problems and principles of the finite element and super-element modeling. They will understand how important it is to choose a right computational model with regard to its validity and coherence of its internal and external elements. The second module describes the content and structure of the user menu for software systems *Structure CAD (SCAD), STARCON (STARK ES), LIRA-SAPR*. Students will possess skills of using methods for creating a number of calculation schemes, the algorithm of solving problems, principles of analyzing and registering the obtained results. The third module gives examples of modeling specific problems both linear and nonlinear related to structural calculation.

Learning Outcomes (Competences)

On completion of the course students will be able to:

- use special design software to solve problems of design and calculation;
- create calculation schemes and make a static and dynamic analysis of building structures using modern finite element software systems;
- model the life cycle of building structures and evaluate the accuracy of computer simulation.

Credit Hours

Learners are expected to earn 3 credits doing 108 hours of work.

In-class training: 54 hours, including 54 hours of practical classes.

Independent work: 54 hours.

Progress Evaluation

Pass/fail exam, 3rd semester.

B.1.A.EC.2.1. Calculation Theory for Structural Engineering

Course Aim

The course focuses on modern methods of calculation, design and construction of load-bearing structures taking into account standards, exploitation conditions and durability and reliability.

Course Description

The course describes loads and impacts; load fluctuation; deformation and internal forces; stresses; the criteria of plasticity, strength and destruction; the method of limit equilibrium; strength and deformation characteristics of materials; methods for determination of internal forces; limit states; structural requirements; the theory of reinforced-concrete resistance; calculation principles of stone and reinforced stone structures, node connections in reinforced-concrete constructions. Students will learn theoretical concepts of steel structures analysis; prestressed structures; the rheological properties of materials and defects in structural calculation; planar and spatial structures. Graduates will study the effect of exploitation conditions on structural calculation and design; structural optimization; the use of the basic research results in design practice; principles of calculation for systems; the use of software systems.

Learning Outcomes (Competences)

On completion of the course students will be able to:

- design building constructions and evaluate their efficiency applying methods of stress and fracture mechanics;
- create proper calculation schemes;
- set boundary conditions for solving two-and three-dimensional problems;
- determine the internal forces, stress, deformation and motion in trusses, plates and solid elements of building constructions theoretically and experimentally;
- use the theory of elasticity and plasticity to assess structural efficiency.

Credit Hours

Learners are expected to earn 6 credits doing 216 hours of work.

In-class training: 72 hours, including 36 hours of lectures and 36 hours of practical classes.

Independent work: 72 hours.

Progress Evaluation

Exam, 1st semester.

Continuous assessment: tests

B.1.A.EC.2.2 Complex Building Systems Engineering

Course Aim

The course focuses on principles of complex building systems design such as truss, shell structures; suspension structural systems which can be statically determined or undetermined; the evaluation of the obtained results.

Course Description

The course describes basic concepts of systems; principles of a systems approach; carrying systems according to H. Engel; classification of systems and load bearing structures; hybrid carrying systems; thin-walled spatial structures; basic equations for truss systems; statically determined and undetermined truss systems; equations for the solution of geometrically and physically nonlinear problems; spatial cable systems; the folding cylinder systems calculation; stability of elastic systems; systems vibration under seismic loading; systems regulation.

Learning Outcomes (Competences)

On completion of the course students will be able to:

- design building constructions and evaluate their efficiency applying methods of stress and fracture mechanics;
- create proper calculation schemes;
- set boundary conditions for solving two-and three-dimensional problems;
- determine the internal forces, stress, deformation and motion in trusses, plates and solid elements of building constructions theoretically and experimentally;
- use the theory of elasticity and plasticity to assess structural efficiency.

Credit Hours

Learners are expected to earn 6 credits doing 216 hours of work.

In-class training: 72 hours, including 36 hours of lectures and 36 hours of practical classes.

Independent work: 72 hours.

Progress Evaluation

Exam, 1st semester.

B.1.A.EC.3.1. Structural Reinforcement (Building Constructions, Bases and Foundations)

Course Aim

The course focuses on the basic principles related to the design of reinforced structures and calculation methods of reinforced building structures, bases and foundations.

Course Description

Students are expected to improve skills and knowledge obtained in the previous study of *Steel structures, Reinforced Concrete and Stone Constructions, Bases and Foundations* (Bachelor's level). The course is delivered in three modules. The first module deals with problems concerning the reinforcement of building structures. Students will learn methods of doing confirmatory calculations for stone, reinforced stone, reinforced concrete and metal building structures; identifying the bearing capacity of structural elements. The second module describes methods of structural reinforcement and its calculation; standard and non-standard constructional decisions on structural reinforcement based on the classification of reinforcement techniques; calculation methods of reinforced concrete and metal structures in general and their elements in particular. Graduates will study design standards related to the calculation of loaded reinforced building structures. The third module focuses on reinforcement techniques for bases and foundations. Students will learn basic reinforcement techniques, calculation methods for reinforced bases and foundations, advanced technologies for the reinforcement of underground parts of buildings and foundations.

Learning Outcomes (Competences)

On completion of the course students will be able to:

- solve theoretical and constructional problems related to the design improvement of buildings and structures;
- use modern methods for diagnostics and monitoring of building constructions relying on experimental methods of determining stress-strain state of structures;
- design reinforced building structures, bases and foundations;
- analyze and use the results of diagnostics and monitoring of buildings and structures to assess their efficiency;
- do confirmatory calculations of building structures, bases and foundations.

Graduates will know:

- methods to control internal forces, stress and deformation in building systems;

- types, causes and effects of defects, damages and deviations in building constructions, bases and foundations.

Credit Hours

Learners are expected to earn 5 credits doing 180 hours of work.

In-class training: 54 hours, including 18 hours of lectures and 36 hours of practical classes.

Independent work: 54 hours.

Progress Evaluation

Exam, 3rd semester.

B.1.A.EC.3.2. Structural Monitoring and Reinforcement

Course Aim

The course focuses on the basic methods of structural monitoring, principles of design and calculation methods of reinforced building structures.

Course Description

Students are expected to improve skills and knowledge obtained in the previous study of *Inspection and Testing of Buildings and Structures*, *Steel structures, Reinforced Concrete and Stone Constructions* (Bachelor's level). The course is delivered in three modules. The first module deals with problems related to monitoring and inspection of buildings and structures in general and their elements in particular. Students will study the types of monitoring and methods for its implementation, tools for monitoring and inspection; methods to analyze defects and damages of buildings elements and their causes. The second module focuses on ways to assess the technical state of buildings and structures, the necessity to reinforce building structures. Students will possess practical skills of doing confirmatory calculations for stone, reinforced stone, reinforced concrete and metal building structures; identifying the bearing capacity of structural elements. The third module describes methods of structural reinforcement and its calculation; standard and non-standard constructional decisions on structural reinforcement based on the classification of reinforcement techniques; calculation methods of reinforced concrete and metal structures in general and their elements in particular. Graduates will study design standards related to the calculation of loaded reinforced building structures.

Learning Outcomes (Competences)

On completion of the course students will be able to:

- solve theoretical and constructional problems related to the design improvement of buildings and structures;

– use modern methods for diagnostics and monitoring of building constructions relying on experimental methods of determining stress-strain state of structures;

– design reinforced building structures, bases and foundations;

– analyze and use the results of diagnostics and monitoring of buildings and structures to assess their efficiency;

– do confirmatory calculations of building structures, bases and foundations.

Graduates will know:

– methods to control internal forces, stress and deformation in building systems;

– types, causes and effects of defects, damages and deviations in building constructions, bases and foundations.

Credit Hours

Learners are expected to earn 5 credits doing 180 hours of work.

In-class training: 54 hours, including 18 hours of lectures and 36 hours of practical classes.

Independent work: 54 hours.

Progress Evaluation

Exam, 3rd semester.

B.2 Practical Experience Including Research Work

B.2.I.1. Industrial Placement

Course Aim

The course focuses on research methods of stress deformation in bearing building structures of constructions, technical inspection and analysis of the results by making conclusions about the technical state of bearing building structures of constructions.

Course Description

The course gives requirements for buildings and structures; it describes models of buildings and foundations according to B. A. Garagash's classification; structural systems of buildings and constructions; impact on buildings and structures; exploitation conditions; constructions standardization and certification; design layout, calculations and analysis results; design requirements and layout; features of design and construction in urban development conditions; structural engineering technology; spatial analysis of buildings on non-homogeneous foundations; scientific support of civil engineering.

Learning Outcomes (Competences)

On completion of the course students will be ready to:

- use modern methods for diagnostics and monitoring of building constructions relying on experimental methods of determining stress-strain state of structures;
- identify the most hazardous areas of building structures, buildings and constructions and modes of loading to control their stress-strain state.

Graduates will know:

- modern methods for the instrumentation control and tools for it; methods for the engineering survey of equipment, monitoring and diagnostics of construction components and projects.

Credit Hours

Learners are expected to earn 8 credits doing 288 hours of work.

In-class training: 18 hours, including 18 hours of lectures.

Independent work: 270 hours.

Progress Evaluation

Graded exam, 2nd semester.

B.2.I.2. Computer-Aided Construction Internship

Course Aim

The course focuses on theoretical concepts and development of practical skills of using modern computer technologies for solving professionally-oriented practical tasks.

Course Description

The course improves knowledge and skills received by students as a result of doing the courses *Design Software for Structural Design Calculation* and *Information Technologies in Civil Engineering*. The course develops students' abilities and practical skills of using modern software for solving practical tasks of civil engineering. Students will learn to use information and computer technologies for solving problems related to their future professional activity.

Learning Outcomes (Competences)

On completion of the course students will be able to:

- use special programming and computing suite for solving problems related to design and analysis;
- use modern finite element software systems for the calculation of building structures with the help of computer technologies.

Credit Hours

Learners are expected to earn 8 credits doing 288 hours of work.

In-class training: 18 hours, including 18 hours of practical classes.

Independent work: 270 hours.

Progress Evaluation

Pass/fail exam, 3rd semester.

B.2.R. Research Work

B.2.R.1. Experimental Research Work

Course Aim

The course is designed to teach students to use measurement and control equipment as well as power units, to measure analyzed parameters, to arrange and conduct experiments, to analyze results.

Course Description

The course focuses on publications related to experimental equipment; research works of the department teaching staff. Students will learn to use specialized equipment, devices, experimental models available at the department. They will possess skills of conducting experiments to understand research methods and objectives; evaluating the obtained results accuracy, identifying possible mistakes in the process of arranging and conducting an experiment; making a report on research work; developing a program of experimental research on the Master's thesis topic.

Learning Outcomes (Competences)

On completion of the course students will be ready to:

- design building constructions and evaluate their efficiency applying methods of stress and fracture mechanics.

Graduates will know:

- methods of the stress-strain related to structural elements and foundation soil.

Credit Hours

Learners are expected to earn 8 credits doing 288 hours of work.

In-class training: 18 hours, including 18 hours of practical classes

Independent work: 270 hours.

Progress Evaluation

Graded exam, 1st semester.

B. 2.W.1. Work Experience Internship

Course Aim

The course is aimed at the development of students' practical skills of using modern methods

for diagnostics and monitoring of building constructions relying on experimental methods of determining the stress-strain state of structures.

Course Description

The course is delivered in modules which develop students' practical skills of using modern methods for diagnostics and monitoring of building constructions relying on experimental methods of determining the stress-strain state of structures. Students will work as interns in one of building organizations or research laboratories to practise skills of using modern methods for diagnostics and monitoring of building constructions relying on experimental methods of determining the stress-strain state of structures.

On the completion of this work students will hand in the following papers to report on the practical experience:

- an explanatory note with the description of the work done in compliance with normative documents;
- a diary of an intern with the brief description of the daily work done, assessed by the Internship Program Leader, bearing the organization stamp and signed by the Director General;
- a statement of personal qualities and achievements, bearing the organization stamp and signed by the Director General.

Learning Outcomes (Competences)

On completion of the course students will be ready to:

- use modern methods for diagnostics and monitoring of building constructions relying on experimental methods of determining the stress-strain state of structures;
- identify the most hazardous areas of building structures, buildings and constructions and modes of loading to control their stress-strain state.

Graduates will know:

- methods for the engineering survey of equipment, monitoring and diagnostics of construction components and projects.

Credit Hours

Learners are expected to earn 6 credits doing 216 hours of work.

Independent work: 216 hours.

Progress Evaluation

Graded exam, 2nd semester.

B2.R.2 Research Internship

Course Aim

The course focuses on the development of students' practical skills of designing building constructions and evaluating their efficiency applying methods of stress and fracture mechanics. Graduates will learn how to solve theoretical and constructional problems related to the design improvement of buildings and structures.

Course Description

The course is delivered in modules which develop students' practical skills of designing building constructions and evaluating their efficiency applying methods of stress and fracture mechanics; solving theoretical and constructional problems related to the design improvement of buildings and structures.

Learning Outcomes (Competences)

On completion of the course students will be able to:

- solve theoretical and constructional problems related to the design improvement of buildings and structures;
- design building constructions and evaluate their efficiency applying methods of stress and fracture mechanics.

Graduates will know:

- methods of designing and analyzing construction components.

Credit Hours

Learners are expected to earn 24 credits doing 864 hours of work.

Independent work: 864 hours.

Progress Evaluation

Graded exam, 4th semester.

Russian as a Foreign Language (3 credits)

Course Aim

The aim of the course is to develop students' proficiency in the Russian language, sufficient to meet basic communication needs in domestic, social and cultural settings when communicating with native speakers in a basic range of situations.

Course Description

The course is for foreign students who have not previously studied the Russian language.

In the process of learning Russian as a foreign language, students will learn basic vocabulary, a set of lexical and grammatical structures sufficient for reading and understanding of simple texts for study and socio-cultural purposes of up to 150 words (e.g., road maps and city signs, names of squares, streets, etc.; retail signs, billboards, ads tours and other cultural events), learn to understand basic conversations (up to 60 words), monologue (up to 120 words). Learners will be able to start conversation and adequately respond to interlocutor's statements (expressing wishes, requests, agreement /disagreement, gratitude, etc., personal attitude to events, facts), to produce coherent utterances on the proposed topic (minimum 7 phrases). International students will learn to cover their communication needs on the following topics: "About myself", "Work", "Study", "Working Day", "Leisure", "Holidays", "Family", and maintain simple conversations on familiar topics, including "Food", "Health", "Weather", "Transportation", "Shopping", "Getting around the city".

Learning Outcomes (Competences)

By the end of the course learners will be able to:

- understand spoken utterances about basic survival needs in areas of immediate need or on very familiar topics, understand simple questions and answers, simple statements and simple face-to-face conversations, understand the topic of the conversation, main and additional information (students will listen to the recording twice);

- read texts for gist; understand and define the theme of the text and its main idea; understand main and additional information of the text;

- create sentences and short paragraphs, produce simple written texts related to most survival needs and limited social demands;

- produce coherent utterances on the proposed topic and cultural setting; respond adequately to interlocutor' statements; start and end conversation in an appropriate manner, express communicative intent within the studied themes and communication situations.

Learning Hours

Learners are expected to earn 3 credits for doing 216 hours of work.

The course is delivered in the 1st semester of the 1st year of study.

Classroom instruction: 108 hours, including 108 hours of practical classes;

Independent work: 108 hours.

Progress Evaluation

Pass/fail exam, 1st semester.