BASICS OF COMPUTER AIDED DESIGN IN CONSTRUCTION

Construction Department

Faculty of Design and Engineering

Lecturer	**Yevhen Anatoliyovich Dmytrenko**
Term	**6,7**
Major	**Bachelor degree**
ECTS credits	**4**
Control	**Exam**
Class-room hours	**120 hours (of them: lectures – 30 hours, practical or laboratory classes – 45 hours)**

Subject overview

The main purpose of teaching the subject is to develop basic knowledge and skills in the calculation and design of three-dimensional bar and plate-bar multiple statically indeterminate design schemes of buildings and structures in a static formulation using modern finite-element and graphic software in construction – LIRA-FEM, Autodesk AutoCAD and Autodesk Revit. The course is aimed at analyzing the results obtained by performing verification calculations manually with elements of load-bearing structures design and bringing the learning process closer to the real activities of design, engineering and operational organizations. It provides students with the necessary knowledge to independently develop project documentation, apply calculation methods in practice, and conduct feasibility analysis.

Lectures:

1. CAD. Basic information. Types and functions. The structure. Modern design systems.
2. Idealization of an object when creating a computer model. Idealization of the shape and geometric parameters of the structure.
3. Idealization of bearing conditions and nodal connections, physical properties of the material. Idealization of loads and impacts on the object. Idealization of design solutions.
4. Finite element method (FEM). General information. History and implementation.
5. Principles of building finite element models. Stiffness characteristics of the elements of the design scheme.
6. The structure of the LIRA-FEM software and the procedure for creating a design model.
7. Design systems of the LIRA-FEM software. Metal structures.
8. Library of finite elements of the LIRA-FEM software.

9. Calculated load combinations. Calculated combinations of forces.
10. Design systems of the LIRA-SAPR software.
11. SP " LIRA-CAD". Main features, functions and applications.
12. BIM technology in architectural and construction design. Part I.
13. BIM technology in architectural and construction design. Part II.

Classes:

(practical, laboratory classes)

1. General familiarization with the interface of the LIRA-FEM software. Calculation of a statically determined single-span articulated beam under load.
2. Calculation of a statically indeterminate flat frame under the action of a single load variant. Setting of hinges.
3. Calculation of a statically determined flat truss under the action of a single load variant.
4. Calculation of a statically defined flat arch under the action of a single load case.
5. Calculation of the spatial frame of a beam cage made of metal structures under the action of several load options. Design of elements.
6. Calculation and design of a statically indeterminate multi-span reinforced concrete beam with several loading options.
7. Calculation and design of elements of reinforced concrete structures of a flat frame core frame.
8. Calculation and design of a flat reinforced concrete slab with several loadings.
9. Calculation and design of elements of reinforced concrete structures of the plate-and-rod frame of the spatial frame on an elastic basis by the LIRA-CAD software.
10. Autodesk Revit software package. Basic commands and functions. Modeling of an individual residential building in the environment of "Autodesk Revit. Part I.
11. Autodesk Revit software package. Basic commands and functions. Modeling of an individual residential building in the environment of "Autodesk Revit. Part II.

BUILDING MATERIAL SCIENCE AND WELDING IN CONSTRUCTION

Department of Material Technology and Material Science

Faculty of Design and Engineering

Lecturer	**Aftandiliants I., Prof.**
Term	**1 year**
Major	**Bachelor degree**
ECTS credits	**6**
Control	**Exam, Tests**
Class-room hours	**90 hours (of them: lectures – 45 hours, laboratory classes – 45 hours)**

Subject overview

The purpose and objectives of the course. Purpose is skills of building material science and welding in construction and laying the basis for the study subjects: “Material science”, “Welding”, "Machine parts", "Hoisting machinery", "Tractors and cars", "Agricultural and meliorative machines", "The safety and repair of machines." Objectives are study methods of obtaining metals and alloys and study of the structure, properties and destination of building materials and welding of metals and alloys. Studying the basic theory of heat treatment of carbon and alloy steels, their technology heat and chemical-heat treatment, as well as specific details and working of building materials and welding of metals and alloys. The study of the structure, properties and appointment of non-metallic construction materials. A result of studying of discipline the student should know the the main connections between the composition, structure and properties of building materials and metals and alloys, as well as patterns and changes in these properties under thermal, chemical or mechanical stress. A result of studying of discipline the student should be able to based on knowledge of the working conditions to work of the building materials and to select of the construction material for their production, type of hardening ore softening treatment for obtaining of the certain the properties of parts and billets.

Lectures:

1. Classification, structure and composition of building materials.
2. Carbon steels and cast irons.
3. The theory of heat treatment.
4. Technology of heat treatment.
5. The alloying theory.
6. Non-ferrous metals and alloys.
7. Inorganic and organic binders of building materials.
8. Aggregates of building materials.
9. Concretes.

10. Ceramic.
11. Polymeric materials.
12. Welding technology in construction.
13. Formation of welded joints and weldability of metal. Classification of welding methods in construction.
14. Electrical Arc welding.
15. Gas welding.
16. Special types of welding.
17. Welding in construction.
18. Classification of welded structures. Features of welding of different types of metals. Basic types of welded joints. Operation of welded joints under different load conditions.
19. Construction welded metal structures: frames of industrial buildings, welded beams, trusses and columns, sheet solid building structures.
20. New welding technologies of constructions.

Laboratory classes:

1. Natural and artificial source building materials.
2. Macrostructural analysis of building materials.
3. Microstructural analysis of building materials.
4. The analysis of state diagram of iron-carbon alloys.
5. Study of the hardness of building materials.
6. Study of the microstructure of carbon steels at equilibrium state.
7. Study of microstructure of cast irons.
8. Structural changes in the carbon steel at heating.
9. Annealing and normalization of carbon steels. Study of microstructure and hardness changes.
10. Quenching of carbon steels.
11. Tempering of quenching steels.
12. Determination of critical temperatures of steels by method of test quenching's.
13. Determination of carbon steel microstructure in a no equilibrium state.
14. Surface hardening steels by high frequency currents.
15. Chemical heat treatment of steels.
16. Definition hardenability steels.
17. Study of microstructure of alloy steels.
18. Determining of the aggregate properties in construction mortars and concretes.
19. Construction of the external characteristics of the electric welding transformer.
20. Determination of modes and technological coefficients of electric arc welding of steel.

CHEMISTRY

Department of General, Organic and Physical Chemistry

Agrobiological Faculty
Speciality 192 Construction and Civil Engineering

Lecturer	**Krotenko V.V.**
Term	**1 course**
Major	**Bachelor**
ECTS credits	**4**
Control	**Exam**
Class-room hours	**120 hours (of them: lectures – 15 hours, practical or laboratory classes – 30 hours)**

Subject overview

Chemistry is a fundamental discipline, which provides engineering students with a background in important concepts and principles of chemistry. Some of the most important objectives, though, are more “global” in nature. Emphasis will be placed on those areas considered most relevant in an engineering context, and practical applications in engineering and technology will be examined These goals deal with the overall relationship between chemistry (or science in general) and engineering rather than with the details of any particular chemical principle.

Overview of chemical engineering through discussion and engineering analysis of physical and chemical processes. Topics: overall staged separations, material and energy balances, concepts of rate processes, energy and mass transport, and kinetics of chemical reactions. Applications of these concepts to areas of current technological importance: biotechnology, energy, production of chemicals, materials processing, and purification.

Lectures:

1. The main concepts and laws of chemistry.
2. The atomic structure.
3. The chemical bond and the structure of molecules.
4. The chemical equilibrium and conditions of its shift.
5. The solutions of electrolytes.
6. The redox processes and their conditions.
7. Bases of electrochemistry.
8. Bases of organic chemical compounds.

Classes:

(practical, laboratory classes)

1. Introduction. Equipment and safety in chemical laboratory. Methods of chemical experiments.
2. Bases of modern nomenclature and classification of inorganic compounds.
3. The structure of the atom and Mendeleev's periodic law.
4. Determination of the types of chemical bonds between atoms in compounds. The relative electronegativity of atoms.
5. Determination of the thermal effect of the neutralization and dissolution of anhydrous salts.
6. Calculation of kinetic parameters of the reaction according to the experiment.
7. Determination of the conductivity of electrolyte solutions.

Indicator method of pH solutions calculation.

8. The preparation of solutions given concentration.
9. The properties of metals in redox reactions.
10 The dependence of electromotive force from galvanic cells of metals.
11. Investigation of electrolysis of aqueous solutions of electrolytes. The calculations of the aount of substances using Faraday's law.
12. Determination of corrosion mass index rate.
13. The chemical properties of metals and their compounds.
14. The genetic link between the classes of organic compounds, the methods of detection og organic compounds.
15. The properties of polymers. Introduction to methods of determining the quality of fuels.

COMPUTERS AND COMPUTER TECHNOLOGIES

Department of descriprive geometry, computer graphics and design

Faculty of Design and Engineering

Lecturer	**Nesvidomin Viktor**
Term	**1,2 semesters**
Major	**Bachelor degree**
ECTS credits	**7**
Control	**Exam**
Class-room hours	**210 hours (of them: lectures – 30/15 hours, laboratory classes – 120 hours)**

Subject overview

Computers and computer technologies are a scientific discipline that studies the principles of construction and functioning of computers, the organization of computing processes on personal computers, their algorithmization, PC software, as well as the effective use of modern information and communication technologies in construction activities. The purpose of discipline is to obtain students theoretical knowledge of the basics of computer technology, to acquire practical skills in working on personal computers using existing CAS and CAD technologies on a PC in solving engineering problems in construction

Virtual reality technologies are one of the disciplines that provide opportunities for students acquire skills in working with virtual, augmented and mixed reality technology, the ability to apply acquired knowledge in working with various CAD programs and the use of these technologies in design.

Lectures:

1. Hardware.
2. Software.
3. Basics of algorithmization.
4. Computer Mathematics Systems.
5. Maple operators.
6. Functions and procedures in Maple. 2D graphics.
7. 3D graphics. Animation.
8. Vector computing in Maple.
9. Matrix computing in Maple.
10. Data processing. Interpolation.
11. Approximation.
12. Approximate methods for solving problems.
13. Programming differential and integral calculus.
14. Optimization.

Laboratory classes:

1. Hardware and software analysis.
2. Units of measurement of information.
3. Linear algorithms.
4. Branched and cyclic algorithms.
5. Writing programs of linear, branched and cyclic algorithms.
6. Writing a program for constructing plane curves.
7. Writing a surface building program.
8. Writing procedures with vector operations.
9. Writing procedures with matrix operations.
10. Data processing. Interpolation.
11. Approximation.
12. Analysis of functions. Solving nonlinear equations.
13. Approximate diff methods. and integral calculus.

CONSTRUCTION MACHINES

Department of Machines and Equipment Design

Faculty of Design and Engineering

Lecturer	**Romasevych Yuriy**
Term	**1 semester**
Major	**Bachelor degree**
ECTS credits	**4**
Control	**Exam**
Class-room hours	**120 hours (of them: lectures – 30 hours, laboratory classes – 30 hours)**

Subject overview

The general **purpose** of the course is to teach students the basics of knowledge about hoisting, conveying, earthworks, concrete and manual machines. The main purpose of the course - is the study of structures, calculation, design, rules of safe operation of hoisting, conveying, earthworks, concrete and manual machines.

Objectives: to teach students to make calculation schemes, to determine the stability and strength of parts, structures, as well as the structural shapes and sizes of the elements of hoisting, conveying, earthworks, concrete and manual machines.

Lectures:

1. Introduction. Characteristics of machines.
2. Belt conveyors.
3. Bucket conveyors.
4. Chain Conveyors.
5. Screw Conveyors.
6. Overhead cranes.
7. Tower cranes and Derricks.
8. Ropes, Blocks-and Tackles.
9. Load-Handling Devices.
10. Hoists and Winches.
11. Earthworks Machines.
12. Concrete Machines.
13. Manual Machines.

Laboratory classes:

1. Belt Conveyor.
2. Screw Conveyor.
3. Bucket Conveyor.
4. Ropes, Block-And-Tackles.
5. Telpher.
6. Jacks.
7. Manual Machines.

MECHANICS OF MATERIALS AND CONSTRUCTIONS

Department of Mechanics

Faculty of Design and Engineering

Lecturer	**Anastasiia Kutsenko**
Term	**2**
Major	**Bachelor degree**
ECTS credits	**6**
Control	**Exam**
Class-room hours	**180 hours (of them: lectures – 60 hours, practical classes – 60 hours)**

Subject overview

Purpose is skills of solving problems of Mechanics of materials and structures and laying the basis for the study subjects: "Structural mechanics", "Concrete and masonry structures", "Metal and wooden structures".

Objectives:

- Study of the methods of calculation of structures for strength, rigidity and stability;

- Study of the stress-strain state of the beam at tension and compression, at direct shear, at torsion and at bending;

A result of studying of discipline the student should:

know:

- The basic hypotheses and methods, which are used of calculations for strength, rigidity and stability of elements of buildings;
- The methods of determining the internal forces factors in statically determinate and statically indeterminate elastic systems;
- The relation among external forces and stresses and displacements in the different kind of simple and complex deformations.

be able:

- To choose the optimal variants of calculation schemes of the elements of constructions;
- To combine calculations into one whole for the building;
- To choose the rational structural materials and the economic sizes of the cross section of the elements of construction.

Lectures:

1. Purpose and objectives of the course. The basic hypotheses and the definitions of the mechanics of materials and constructions.
2. The relation among internal forces and tensions in case of tension or compression of the bar.

3. The method of calculating the bar on strength.
4. The method of calculating the bar on rigidity.
5. The geometric characterizations of the plane cross sections.
6. The geometric characterizations of the plane cross sections.
7. Analysis of Stress and Strain.
8. The direct shear stresses.
9. The definition of torsion.
10. The method of calculating the bar on strength and rigidity by torsion.
11. The equation of Shearing force for the cantilever and simple beams.
12. The equation of Bending moment for the cantilever and simple beams.
13. The calculation method cantilever beam on the strength by the normal stresses.
14. The calculation method simple beam on the strength by the normal stresses.
15. Verescagin´s rule.
16. The method of initial parameters.
17. Castigliano´s theorem.
18. The construction method of the diagrams of shear-force and bending-moment for the cantilever frame.
19. The construction method of the diagrams of shear-force and bending-moment for the simple frame.
20. The curveted beam.
21. The definitions of the statically indeterminate constructions.
22. The application of the Castigliano´s theorem to the statically indeterminate constructions.
23. The three moment's theorem.
24. The application of the Verescagin´s rule to the statically indeterminate constructions.
25. Analysis of Stress and Strain in the case of the action of compression and bending at one time.
26. Analysis of Stress and Strain in the case of the action of tension and bending at one time.
27. Analysis of Stress and Strain in the case of the action of two bending moments at one time, which acting in perpendicular planes.
28. The calculation method of column.
29. Analysis of Stress and Strain in the case of the action of bending and torsion at one time.

Practical classes:

1. The calculation of the bar on strength.
2. The calculation of the bar on rigidity.
3. The geometric characterizations of the plane cross sections.
4. The direct shear stresses.
5. The method of calculating the bar on strength and rigidity by torsion.

6. The construction of diagram of Shearing force for the cantilever and simple beams.
7. The construction of diagram of Bending moment for the cantilever and simple beams.
8. The calculation of cantilever beam on the strength by the normal stresses.
9. The calculation of simple beam on the strength by the normal stresses.
10. The calculation of beam strain by Verescagin´s rule.
11. The calculation of beam strain by the method of initial parameters.
12. The calculation of beam strain by the Castigliano´s theorem.
13. The construction of the diagrams of shear-force and bending-moment for the cantilever frame.
14. The construction of the diagrams of shear-force and bending-moment for the simple frame.
15. The curveted beam.
16. The definitions of the statically indeterminate constructions.
17. The application of the Castigliano´s theorem to the statically indeterminate constructions.
18. The three moment's theorem.
19. The application of the Verescagin´s rule to the statically indeterminate constructions.
20. The calculation of.
21. The calculation of column in the case of the off-centre acting force of compression.

REINFORCED CONCRETE AND STONE STRUCTURES

Construction Department

Faculty of Construction and Design

Lecturer	**Yakovenko Ihor Anatoliiovych**
Term	**7 and 8**
Major	**Bachelor degree**
ECTS credits	**7**
Control	**Test (7 term), Exam (8 term)**
Class-room hours	**210 hours (of them: lectures – 56 hours, laboratory classes – 56 hours)**

Subject overview

The purpose of the discipline "Reinforced concrete and stone structures" is the comprehensive training of bachelors in construction and civil engineering. Students must know and are able to apply the principles of designing and constructing concrete, reinforced concrete, stone and reinforced stone structures of buildings and structures of agro-industrial, industrial, civil and transport purpose to rationally appoint effective structures for the further construction of buildings and engineering structures.

The task of the educational discipline is the student's acquisition of knowledge and skills regarding the general principles of design, construction of reinforced concrete and stone structures of buildings and engineering structures of industrial, agro-industrial, civil and transport construction; assimilation of the design principles of covering structures, ceilings, crossbars, columns, foundations, etc., in accordance with current regulatory documents.

The discipline involves the study of theoretical material, which is presented in four content modules.

Lectures:

1. General information on the development and evolution of concrete and reinforced concrete structures.
2. Basic provisions for the calculation of concrete and reinforced concrete structures.
3. Reinforcement of reinforced concrete structures.
4. Calculation of reinforced concrete structures according to normal sections.
5. Calculation of reinforced concrete structures according to inclined sections.
6. Calculation of reinforced concrete structures with central and non eccentricity load application.
7. Crack resistance of reinforced concrete structures.
8. Calculation of elements of reinforced concrete structures by deformations.
9. Stone and decorative stone structures. Mechanical characteristics of masonry.
10. Calculation of unreinforced elements of stone structures.
11. Calculation and design features of reinforced stone elements.

12. Stone elements reinforced with clips.

13. Structural schemes of stone buildings and their calculation.

14. Calculation and design of multi-layer walls and support nodes.

15. Calculation of basement walls. Features of installation of expansion joints in buildings.

16. Flat reinforced concrete floors, their types and classification.

17. Ribbed monolithic ceilings with beam slabs.

18. Ribbed monolithic ceilings with slabs supported along the contour.

19. Beam prefabricated and prefabricated monolithic ceilings.

20. Beamless monolithic, prefabricated and prefabricated monolithic ceilings.

21. Reinforced concrete foundations. General Information. Separate foundations for columns. Basics of construction.

22. Tape foundations for walls and columns. Solid foundations.

23. One-story production frame buildings and their structural systems.

24. RCC of single-story industrial buildings: trusses, arches and slabs, crane beams, columns and foundations

25. Spatial reinforced concrete coatings and their classification.

26. Reinforced concrete tanks. Water towers.

27. Features of construction of reinforced concrete bunkers. Reinforced concrete silos.

28. Design and construction of retaining walls.

Laboratory classes:

1. Determination of the load-bearing capacity rectangular cross-section for reinforced concrete structures which work in bending with single reinforcement by normal cross-sections.

2. Determination of the required reinforcement area for reinforced concrete structures that work for bending with single reinforcement by normal sections.

3. Determination of the load-bearing capacity of rectangular cross-section for reinforced concrete structures, which work for bending with double reinforcement by normal cross-sections.

4. Determination of the required reinforcement area for reinforced concrete structures that work in bending with double reinforcement by normal sections.

5. Strength calculation of reinforced concrete structures, which work in bending of the T-shaped section with a shelf in (or outside) the compressed zone.

6. Determination of the required reinforcement area for reinforced concrete structures of T-shaped section, which work in bending along normal sections.

7. Bearing capacity determination of inclined sections for reinforced concrete structures by transverse force. Structural requirements for the design of reinforced concrete structures by inclined sections.

8. Calculation of reinforced concrete structures that work in compression. Geometric imperfections and the effect of the second order.

9. Algorithms for calculating reinforced concrete compressed elements according to the first and second forms of equilibrium. Determination of the bearing capacity for centrally compressed reinforced concrete column of a multi-story building.

10. Determination of the required reinforcement area for an eccentrically compressed reinforced concrete column of rectangular section with a given initial eccentricity.

11. Determination of physical-mechanical and deformation characteristics of brickwork. Calculation examples.

12. Checking the bearing capacity of the centrally loaded wall of a public building.

13. Determination of the bearing capacity for an eccentrically loaded reinforced brick column with a given eccentricity.

14. Strengthening the brick wall by installing a steel bracket from the corners.

15. Checking the bearing capacity of the basement wall of a brick building.

16. Layout of structural schemes and selection of the optimal variant for monolithic reinforced concrete ribbed floor with beam slabs.

17. Calculation and construction for monolithic reinforced concrete ribbed floor slab along the main and secondary beams.

18. Calculation of the secondary beam for monolithic reinforced concrete ribbed floor: construction of the calculation scheme, static calculation, specification of cross-sectional dimensions.

19. Calculation of the secondary beam for monolithic reinforced concrete ribbed floor: construction of the calculation scheme, static calculation, specification of cross-sectional dimensions.

20. Calculation of the strength for secondary beam for monolithic reinforced concrete ribbed floor in normal and inclined sections.

21. Design of the secondary beam for monolithic reinforced concrete ribbed floor: construction of the contour plot of moments, construction of the plot of materials, anchoring of longitudinal reinforcement.

22. Calculation of monolithic reinforced concrete foundations for compression columns.

23. Reinforcement determination for prestressed reinforced concrete floor beam of rectangular section, 9 meters long.

24. Determination of the crack opening width for reinforced concrete beam of rectangular section with prestressed reinforcement under the action of operational and quasi-permanent design moments.

25. Determining the amount of rectangular section deflections for reinforced concrete beam with prestressed reinforcement under the action of operational and quasi-permanent design moments.

26. Calculation of a monolithic reinforced concrete floor slab, which is supported on four sides without prestressing the section during compression.

27. Calculation of a beamless monolithic reinforced concrete floor slab for a section during compression at the location of the middle column.

28. Determination of shear resistance for pushing slabs and foundations under columns without transverse reinforcement and with transverse reinforcement.

RELIABILITY OF CONSTRUCTION EQUIPMENT

Department of Reliability of equipment
Faculty of Design and Engineering

Lecturer	**Bannyi O.**
Term	**3 year**
Major	**Bachelor degree**
ECTS credits	**4**
Control	**Exam**
Class-room hours	**60 hours (of them: lectures – 30 hours, laboratory classes – 30 hours)**

Subject overview

The course "Reliability of construction equipment" is a complex discipline that contains basic information about the theoretical foundations of reliability and construction repair technology techniques. The production process of repairing machines and equipment. The structure of technological process, main stages. Preparation, reception, cleaning of repair objects. Defecation, assembly of parts. Disassembly and assembly of units and aggregates. Painting objects repair. The purpose of the discipline is to acquire knowledge and skills acquired in the process of study disciplines The role of discipline is to repair machines in the formation of culture engineering thinking in order to develop the capabilities of ensuring durability, performance, maintainability and maintainability of construction machines in the process development, creation and operation of equipment.

Lectures:

1. Basic terms, concepts and definitions.
2. Engineering and physical foundations of reliability.
3. Mathematical methods of determining reliability indicators.
4. Reliability of machines as complex systems for forecasting earnings per failure.
5. Reliability tests.
6. Operational and repair assessment of product design manufacturability (ETKV and RTKV).
7. Methods of ensuring machine reliability.

Laboratory classes:

1. Reliability of equipment. Basic terms, concepts and definitions.
2. Wear resistance of products. Friction. wear and tear. Terms and definitions.
3. Damage to machine parts that are being repaired.
4. Forecasting the resource of machine parts.
5. Processing of information about the reliability of machines.
6. Defect of rolling bearings.
7. Defects of basic machine parts.
8. Control and sorting of gears and splined shafts.

THEORETICAL AND STRUCTURAL MECHANICS (STRUCTURAL MECHANICS)

Department of Mechanics

Faculty of Design and Engineering

Lecturer	**Anastasiia Kutsenko**
Term	**2, 3**
Major	**Bachelor degree**
ECTS credits	**5**
Control	**Exam**
Class-room hours	**150 hours (of them: lectures – 60 hours, practical classes – 60 hours)**

Subject overview

Structural mechanics is the science of principles and methods of determination stress-strain state of typical calculation of complex models, their analysis of stability and dynamic behavior.

As an educational and scientific discipline construction mechanics is based on courses in theoretical mechanics, strength of materials, theory of elasticity and higher mathematics. The methods of Structural mechanics are basis for the design of modern agricultural buildings.

In the future, the students will be useful acquired knowledge: for studying special disciplines and performing research and graduation works.

In process studying the discipline "Structural Mechanics" students develop skills of engineering thinking that makes it possible to optimize the parameters of agricultural purpose buildings and agricultural machines.

As a result of studying this discipline, the student should

know:

- basics of the mechanics of a deformable solid body;
- the influence of the properties of the construction material, shape and dimensions, limit working loads of real objects on their strength and stability;
- general principles of building mathematical models of solids bodies;
- numerical methods for calculating complex systems;
- experimental methods of Structural mechanics

be able:

- to develop mathematical models of construction structures that operated in an agro-industrial complex;
- competently use numerical methods of calculating rods systems and spatial thin-walled structures.

Lectures:

1. The kinematic analysis of the complex structures.
2. The calculations of a complex beam.
3. The construction of the diagram of internal efforts for a complex beam.
4. The construction of lines of influence of reactions for a simple beam.
5. The construction of lines of influence of internal efforts for a simple beam.
6. The construction of lines of influence of internal efforts for a complex beam by general method.
7. The construction of lines of influence of internal efforts for a complex beam by kinetic method.
8. Kinematic analysis of the trusses.
9. The calculation of the truss by the method of joints.
10. The calculation of the truss by the method of sections.
11. The calculation of the truss under the snow load.
12. The calculation of the truss on rigidity.
13. The determination of reaction supports of a curved beam.
14. The construction of diagram of the normal and shear forces for a curved beam.
15. The construction of the diagram of shear forces for a curved beam.
16. The construction of the diagram of the bending moment for a curved beam.
17. The determination of support reactions of a three-hinged arch
18. The construction of diagram of the normal force for a a three-hinged arch.
19. The construction of the diagram of sheare forces for a a three-hinged arch.
20. The construction of diagram of the bending moment for a three-hinged arch.
21. The determination of support reactions of a three-hinged arch
22. The construction of diagram of the normal force for a a three-hinged arch.
23. The construction of the diagram of sheare forces for a a three-hinged arch.
24. The construction of diagram of the bending moment for a three-hinged arch.
25. The calculation of a complex frame.
26. The calculation of a statically indefinitely frame by force method.
27. The calculation of a statically indefinitely frame by method of deflections.
28. Calculation of frames under stability by the method of deflections.
29. The basics of calculating structures according to the limit states method.

Practical classes:

1. Kinematic analysis of a complex beam.
2. The determination of reaction supports of a complex beam.
3. The verification of the static balance of a complex beam.
4. The construction of the diagram of normal forces for a complex beam.
5. The construction of the diagram of shear forces for a complex beam.
6. The construction of the bending moment diagram for a complex beam.
7. The construction of lines of influence of reactions for a simple beam.
8. The construction of bending moment lines of influence for a simple beam.
9. The construction of lines of influence of shear forces for a simple beam.
10. The construction of lines of influence of internal forces for a cantilever beam.
11. Kinematic analysis of the trusses.
12. The calculation of the truss by the method of joints.
13. The calculation of the truss by the method of sections.
14. The calculation of the truss under the snow load.
15. The calculation of the truss on rigidity.
16. The determination of reaction supports of a curved beam/
17. The construction of diagram of the normal force for a curved beam.
18. The construction of the diagram of shear forces for a curved beam.
19. The construction of the diagram of the bending moment for a curved beam.
20. The determination of support reactions of a three-hinged arch
21. The construction of diagram of the normal force for a a three-hinged arch.
22. The construction of the diagram of sheare forces for a a three-hinged arch.
23. The construction of diagram of the bending moment for a three-hinged arch.
24. The determination of support reactions of a three-hinged arch
25. The construction of diagram of the normal force for a a three-hinged arch.
26. The construction of the diagram of sheare forces for a a three-hinged arch.
27. The construction of diagram of the bending moment for a three-hinged arch.
28. The determination of reaction supports of a complex frame.
29. The construction of the diagrams of normal force and shear force for a complex frame.
30. The construction of the bending moment diagram for a complex frame.

THEORIES OF VIRTUAL REALITY

Department of descriprive geometry, computer graphics and design

Faculty of Design and Engineering

Lecturer	**Nesvidomin Andrii**
Term	**7 semesters**
Major	**Bachelor degree**
ECTS credits	**4**
Control	**Exam**
Class-room hours	**120 hours (of them: lectures – 30 hours, laboratory classes –60 hours)**

Subject overview

Virtual reality technologies are one of the disciplines that provide opportunities for students acquire skills in working with virtual, augmented and mixed reality technology, the ability to apply acquired knowledge in working with various CAD programs and the use of these technologies in design.

Lectures:

1. Technologies virtual, supplemented and mixed reality.
2. Virtual and augment reality in environment SolidWorks.
3. Virtual, supplemented with mixed reality in environment Autodesk VRED.
4. Virtual reality in the SketchUp.
5. Using virtual reality in Unreal Engine.
6. Settings environment virtual reality in Unity.
7. Creating 3D models with virtual reality in Tilt Brush and Gravity Sketch.
8. Settings augment and mixed reality.

Laboratory classes:

1. Settings environment of virtual reality in Oculus Rift.
2. Research solid models in virtual environment SolidWorks.
3. Virutal laboratory in Autodesk VRED.
4. Creation project in environment SketchUp and his research in virtual reality.
5. Import and CAD editing files in virtual reality in Unreal Engine.
6. Creation virtual environment in Unity.
7. Creating 3D models in virtual reality in the Gravity Sketch.
8. Creation photorealistic image in CAD programs.