PROBLEMS FOR DIPLOMA EXAMINATION OF 1ST CYCLE STUDIES

1.	Cross-section forces in frame structures.
2.	Analysis of strain and stress state at a point.
3.	Buckling of straight bars, buckling modes, methods to calculate critical forces.
4.	Influence lines of static forces in bar structures.
5.	Basic methods to solve statically indeterminate bar structures.
6.	Dynamic influences in civil engineering, dynamic characteristics of structures. Taking into account the dynamic effects on civil engineering structures.
7.	Ultimate limit state design based on strength of materials.
8.	Classification, basic characteristics and test methods for building materials and products.
9.	Basic properties of concrete constituents and general rules of their quality assessment; influence of constituent properties on concrete strength and other properties.
10.	Factors determining the durability of building materials.
11.	Principles of concrete strength and other properties evaluation in the light of requirements of the current national and European standards.
12.	Material, structural and technological solutions of housing, commercial and industrial buildings.[1]
13.	Thermal and moisture aspects of designing buildings envelope and their construction details.
14.	Advantages and disadvantages of traditional and new finishing elements of building.[2]
15.	Actions on structures. Traffic loads on road bridges, foot bridges and railway bridges.
16.	Limit states for building structures. Classification, safety requirements and design rules.
17.	Calculation models for building structures.
18.	Conceptual designing of steel structures with respect to the classification of steel cross-sections.
19.	The influence of imperfections on the load-bearing capacity of steel structures.
20.	Joints and connections in the steel structures.
21.	Simplified methods for reinforced concrete / pre-stressed concrete cross-section design in structural elements for different load cases.

[1] building foundations (direct and indirect, excavations, hydroprotection of foundations and basements of buildings), walls (masonry and prefabricated walls, heat-insulating multilayer walls, timber walls, light curtain walls), chimneys designing (traditional systems and chimney blocks), lintels, floors (timber floors, monolithic and prefabricated floors, rib-and-slab floors, floors with steel beams), communication elements (stairs, lifts, ramps), roofs (types of roofs, timber construction of roofs – roof rafters, flat roofs, large span roof structures).

[2] windows, doors, flooring, plastering, internal and external linings, roof tiles and steel sheets.

22.	Execution of pre-stressed and post tensioned concrete structures – materials, systems of pre-stressing, technology of execution.
23.	Design rules and detailing for simple structural reinforced concrete elements (slabs, beams).
24.	Design rules and detailing for simple structural reinforced concrete elements (frames, foundations).
25.	Design rules for machine foundation.
26.	Rules of design and detailing of simple precast structures – phases of work, support zone of precast elements, connections and joints, pocket type precast foundations.
27.	Modern production technologies of concrete precast products The influence of production method on precast element properties.
28.	Basic structural systems for concrete, steel and composite steel and concrete bridge structures.
29.	Basis of design, sizing, detailing and construction methods for typical beam/deck single and multi-span concrete bridges.
30.	Basic technologies of bridges construction. Methods of tunnels construction.
31.	Design of roads and streets in the horizontal and vertical planes – cross-section, layout and grade line
32.	Rail and road superstructures
33.	Transportation service in urban areas
34.	Earthworks technology
35.	Technology of concrete works and reinforced concrete works
36.	Site assembly of building structures
37.	Works planning and organization
38.	Development of a building site

PROBLEMS FOR DIPLOMA EXAMINATION OF 2ND CYCLE STUDIES

Building and Engineering Structures

1.	Formulations of the boundary value problems (local and global) and conceptions of their approximate solutions.
2.	Selected numerical methods (approximation of functions, solution of: linear and nonlinear algebraic equations as well as systems of such equations, algebraic eigen problems, differential equations) that are used in computational mechanics.
3.	Idea of FEM discretization for 1D and 2D problems.
4.	The basic similarities and differences between FEM and FDM concepts.
5.	Classification of error sources in computational methods.
6.	Behaviour of rod systems subjected to geometric and thermal loads.
7.	Natural and forced vibrations, resonance and damping.
8.	Types, properties and application of advanced building materials and products.
9.	Basic issues of structures protection against corrosion
10.	Structural systems in buildings, spatial rigidity.
11.	High-rise RC monolithic and prefabricated frame buildings.
12.	Masonry buildings: types, construction rules and calculation methods.
13.	Timber structures: timber as a structural material - characteristics, advantages and disadvantages, residential timber buildings, types of roof rafters and their elements, glued-laminated timber, laminated veneer lumber (LVL), laminated strand lumber (LSL) and their use in constructions, designing of timber structures, connectors in timber structures. Wood protection.
14.	Energy-efficient building systems, thermal and moisture aspects of materials and building partitions (walls, floors, roofs, flat roofs, woodwork), methods of reducing heat losses through infiltration and ventilation, renewable energy. Energy assessment of buildings.
15.	Construction and calculation problems of steel basic structures: cross-section, bar member, frame.
16.	Influence of local buckling on carrying capacity of steel girders
17.	Construction and calculation problems of steel hall/skeleton buildings
18.	Construction and calculation problems of certain metal sheets structures (e.g. tanks, silos, pipelines).
19.	Basis of prefabrication and typification of concrete elements and structures (types of connections, support conditions of precast elements); the issues of structural design and detailing of precast structures, including liquid storage tanks.
20.	Design, dimensioning and detailing of advanced RC structural systems (frames, slab – column systems, deep walls).

21.	General method of design of concrete pre-stressed structures - analysis of magnitude of pre-stressing force, design rules for elements subjected to bending and shear forces.
22.	Rules of designing of pre-stressed and post-tensioned concrete floors.
23.	Rules of designing and detailing reinforcement in monolithic storage tanks for liquids and bulk materials.
24.	Design rules for machine foundation.
25.	Basis of design, sizing, detailing and construction methods for long span pre-stress bridges: pre-tensioning and posttensioning.
26.	Principals of bridge substructure design, sizing, detailing and construction.
27.	Structural analysis and limit state design for typical deck and beam/deck types of bridge structures.
28.	Structural assessments, repairs and strengthening of bridge structures by means of FRP and/or external tendons.

PROBLEMS FOR DIPLOMA EXAMINATION OF 2ND CYCLE STUDIES

Bridges and Underground Structures

1.	Formulations of the boundary value problems (local and global) and conceptions of their approximate solutions.
2.	Selected numerical methods (approximation of functions, solution of: linear and nonlinear algebraic equations as well as systems of such equations, algebraic eigen problems, differential equations) that are used in computational mechanics.
3.	Idea of FEM discretization for 1D and 2D problems.
4.	The basic similarities and differences between FEM and FDM concepts.
5.	Classification of error sources in computational methods.
6.	Behaviour of rod systems subjected to geometric and thermal loads.
7.	Natural and forced vibrations, resonance and damping.
8.	Types, properties and application of advanced building materials and products.
9.	Basic issues of structures protection against corrosion.
10.	Masonry buildings: types, construction rules and calculation methods.
11.	Timber structures: timber as a structural material - characteristics, advantages and disadvantages, residential timber buildings, glued-laminated timber and its use in constructions and bridges.
12.	Energy-efficient building systems and thermal renovation of existing buildings: thermal and moisture aspects of materials and building partitions, structure details (insulated multilayer walls, floors, roofs, flat roofs).
13.	Basis of prefabrication and typification of concrete elements and structures (types of connections, support conditions of precast elements); the issues of structural design and detailing of precast structures, including liquid storage tanks.
14.	Design, dimensioning and detailing of advanced RC structural systems (frames, slab – column systems, deep walls).
15.	Determination of non-traffic actions for persistent design situations for bridge structures. Traffic loads on road bridges, foot bridges and railway bridges.
16.	Basic geometrical parameters of bridge structures, their importance and implications on final design.
17.	Basis of design, sizing, detailing and construction methods for pre-stress bridges.
18.	Basis of design, sizing, detailing and construction methods for steel (plate girders) and composite steel and concrete bridges.
19.	Cross frames, wind bracings, diaphragms and other stiffening members in steel bridges.
20.	Bridge bearings. Basic types, design requirements, inspection and maintenance of bridge bearings.

21.	Bridge substructure (piers and abutments). Basis of design, structural analysis and foundation types.
22.	Bridge furniture (safety barriers on the external edge and central crash barriers; drainage systems; utility troughs; concrete parapet; steel pedestrian railing on top on the external edge; piping; lamp-posts, etc.).
23.	Road tunnels and underground pedestrian passages. Basic of design and construction.