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Diploma Examination – Questions (first-circle study)

Questions for all specializations

NOTE: The # symbol separates the main part of the question (which is always displayed) from the auxiliary part (which may be invisible because it is a hint for the question). If the question does not contain the auxiliary part, the question is terminated with #.

ALL 01/S/RB2: Concrete as a fundamental material of building structures#(classification of concrete structures; cooperation of concrete and steel in the loads balancing; general features, advantages and disadvantages of reinforced concrete structures)

ALL 02/S/RB2: Verification of the ultimate limit state of the rectangular section under bending moment, according to simplify method #(forces distribution in the ultimate limit states, equilibrium of forces, ultimate limit state conditions, calculation algorithm)

ALL 03/S/RB2: One way reinforced concrete slabs#(geometry of: cantilever slabs, simple slabs, continuous slabs)

ALL 04/S/RB2: Hollow-tile slabs #(types of hollow-tile slabs /examples, rules for assuming the cross sections of ribs in case of different sorts of hollow-tile slabs)

ALL 05/S/RB2: Product forms of reinforcement, properties of reinforcement#(classes of reinforcement, symbols, stress-strain diagrams of typical reinforcing steel)

ALL 06/S/RB2: Steel members under compression#(examples, resistance of cross-section, stability)

ALL 07/S/RB2: Steel members under bending#(classification and resistance of cross-sections, lateral-torsional buckling)

ALL 08/S/RB2: Steel trusses and lattice girders#(geometry, cross-sections of members, calculation, constructional details and constructing of joints)

ALL 09/S/RB2: Bracing systems in single-storey steel buildings#(types of bracing, their role in a structure, rules of their arrangement)

ALL 11/S/RB7: Characteristic of municipal infrastructure systems (water pipe systems and urban sewerage, materials of pipes)

ALL 12/S/RB7: Pipelines#(rules of pipe laying in the trenches, pipes – soil interaction, statitc and strenght analysis of buried pipelines, design criterions)

ALL 13/S/RB7: Water supply and sanitary instalations # (design(ing) principle of instalations, elements of the instalations and device, materials of instalations)

ALL 14/S/RB7: Geodesic coordinate systems: flat rectangular (X, Y) and heights (H), constituting the national system of spatial references system

ALL 15/S/RB7: Geodesic instruments used to the surveying service of the construction and raisings of objects #()

ALL 16/S/RB7: Databases from which data is collected to create a base map. Geodetic and cartographic documents used for design purposes #()

ALL 17/S/RB7: The structure of SIP (Spatial Information System)#()

ALL 18/S/RB3: The main technical characteristics of construction materials#(physical, chemical and mechanical properties of construction materials. Technical properties required in the individual elements of the building or structure, highlighting the characteristics of the primary and additional importance.)

ALL 19/S/RB3: Mineral binder -definition, types of binders, the major differences in the properties, the scope of application#(classification: the type of raw materials, chemical and technical characteristics, behaviour in the aquatic environment, the scope of application. The processes of setting and hardening, chemical reactions, the binding environment. Achievement of the strength properties, strength properties. Shrinkage and swelling)

ALL 20/S/RB3: Basic methods of concrete proportioning#(the essence of design and its overall process. The basic assumptions for the design (including technology), obtain the properties of concrete after a suitable period of hardening due to use in design and operating conditions, strength and durability. Quality selection of concrete components (selection criteria). Quantitative selection of components by the application of appropriate design methods (the experimental methods, the analytical and experimental methods - method of grout and the analytical method - method of the three equations)

ALL 21/S/RB3: Building process as technological and organization system#(the concept and model of system, its theme and structure. The properties of the process as a technological and organizational system. Associations of the building process with the environment)

ALL 22/S/RB3: Division and characteristics of the basic technologies of the construction. Manufacturability of structure# (describe the basic technologies and their relevant construction and technological properties. Give the definition of manufacturability of structure (ease of realization of structure) and on this basis characterize basic technologies of construction)

ALL 23/S/RB3: Basic technological processes of concreting and their impact on concrete properties#(Aim, essence and the basic parameters of technological processes of concreting: (1) mixing; (2) transport; (3) placing; (4) compacting; (5) curing. The most important requirements of technological processes of concreting. The consequences of an incorrect performance of concreting processes on the properties of concrete)

ALL 24/S/RB3: The formula of calculation of the estimated cost of construction works#(Cost estimator components - estimated cost of construction works = direct costs (labour value + value of construction materials + value of equipment) + indirect costs + calculated profit + value added tax (VAT). Direct costs calculated as the size of the bill of quantities x expenditures from norm x unit price of the factor of production. Indirect costs calculated as cost index of labour component +

equipment. Profit calculated as an index of profit from labour components, equipment and indirect costs (as direct components of an enterprise))

ALL 25/S/RB3: The principles of management, rules and principles#(Elements of scientific work organization. Principles of organized resources and measures. Principle of the use of research and experimentation, standardization of work, optimal result, division of work and control, concentration, harmonization. Principle of uniformity and rhythmicity of work. Principle of application of reserves, prevention and order of material. Organized cycle of action)

ALL 26/S/RB3: The methods of planning construction works#(Construction schedules. Analytical part of the study. Graphical imaging. Mathematical method - boundary networks - event, process, dependency. Checking schedules - employment, material supplies, equipment work, financial)

ALL 27/S/RB3: Basic elements of the development of the construction site#(Preparation of the construction site for the realization of the building. Site development; permanent and temporary. Development elements: organization of vertical and horizontal transport means, variable workplaces, temporary roads, requisite landfills, others, shelters and warehouses, auxiliary and field laboratories, social and office facilities, production media installations, fire prevention and safety measures work, means of communication and protection, fencing)

ALL 28/S/RB3: Participants in the investment process, their role and tasks in accordance with the construction cycle#(Direct investor, substitute investor - investor supervision inspector. Bank. Designer - author's supervision. Contractor - construction manager. Suppliers of capital goods. Construction supervision: state, industry, specialist. Owner of the building - operation of the object. Research facilities to develop technical progress in the construction industry)

ALL 29/S/RB5: Bending of bar/beam elements#(distribution of strain and stress in the cross-section; one-directional (pure) bending vs. two-directional bending; design of the cross-section of a member)

ALL 30/S/RB5: Eccentric load on bar/beam elements#(distribution of strain and stress in the cross-section; design of the cross-section of a member; cross-section core)

ALL 31/S/RB5: Torsion of bar/beam elements#(circular vs. noncircular cross-sections– differences in the analysis of the case; distribution of strain and stress in the cross-section; design of the cross-section of a member)

ALL 32/S/RB5: Complex state of stress#(principal stresses and directions; influence of shear force on state of stress in bar/beam element; concept of reduced/equivalent stress; designation of reduced/equivalent stress in bar/beam element)

ALL 33/S/RB5: Geometrical invariance of static systems #(answer must be illustrated by sketches; necessary criterion of geometrical invariance; special criterions of geometrical invariance; methods of evaluation of geometrical invariance)

ALL 34/S/RB5: Influence lines#(answer must be illustrated by sketches; concept of influence line; static and kinematic determination of influence lines in statically determinate systems; application of influence lines to loads' envelope determination)

ALL 35/S/RB5: Force Method#(theoretical basis; general algorithm of the method for bar/beam system; answer must be illustrated by sketches showing correct static systems)

ALL 36/S/RB5: Displacement Method#(theoretical basis; versions of the method − matrix, classic; general algorithm of the method for bar/beam system; practical application of the method)

ALL 37/S/RB6: Control of the Serviceability Limit States of reinforced concrete elements#(the SLS classification; why the SLS requires control?; main conditions of the SLS check and appropriate methods; phenomena taken in account in the SLS check)

ALL 38/S/RB6: Types of reinforcement in reinforced concrete elements#(purpose of reinforcement, classification of reinforcement types used in reinforced-concrete (due to internal forces and due to its purpose); arrangement of reinforcement in cross-section and longitudinally in the RC-element))

ALL 39/S/RB6: Design of reinforced concrete elements under bending, eccentric compression and tension – differences and similarities in design procedures in each case#(the answer requires only comparison and marking differences and similarities; needs to be mention: methods of reinforcing of the RC-elements, main design conditions, marking when (1) the comprehensive analysis of the whole element is required and when (2) only the cross-sectional analysis is required, methods of shaping of the cross-section (due to internal forces)

ALL 40/S/RB6: Shear design of reinforced concrete beams#(design shear resistances VRd,c, VRd,s VRd,max and their influence on design; regions (1) not requiring design shear reinforcement and regions (2) requiring design shear reinforcement; design shear length, shear reinforcement)

ALL 41/S/RB6: General classification of reinforced concrete foundations. Methods of foundation design on the concrete footing example#(classification of the foundations due to foundation depth and the foundation shape; shaping of the concrete footing; choice of the foundation dimensions and influence of the soil conditions and the load patterns; methods of the foundation reinforcement dimensioning)

ALL 42/S/RB6: Reinforced concrete stairs#(structural classification of reinforced concrete stairs; structural elements of the stairs, slab stairs, dimensioning rules and examples of the slab stairs without landing beams and stringers; examples of reinforcement)

ALL 43/S/RB7: Classification of the geological processes – endogenous and exogenous processes#(brief characteristic and mutual relation, the cycle of geological processes)

ALL 44/S/RB7: The influence of the aeolian, glacial and fluvial processes on ground conditions in the substrate #(erosion and transportation; aeolian, glacial and fluvial deposits; meanings of the aeolian, glacial and fluvial processes for the engineering activity of human)

ALL 45/S/RB7: Physical properties of cohesive and cohesionless soils#(parameters determining physical states and methods of their estimation)

ALL 46/S/RB7: Groundwater and the connected phenomenon#(types of groundwater, Darcy's law, water permeability, phenomenon connected with water flow: quicksand, scouring, etc.)

ALL 47/S/RB7: Parameters describing the strength and deformability of soils#(Characteristic and design values of parameters; methods for parameter estimation)

ALL 48/S/RB7: Geotechnical categories#(knowledge of the Ordinance of the Minister of Interior and Administration of 24.09.1998. Dz.U. No 126, Pos. 839)

ALL 49/S/RB7: Slope stability#(landslide classification; earth structure stability; stability factor; general description of slopes determination methods)

ALL 50/S/RB7: Limit states in design of shallow foundations#(types and cases of limit states and their form)

ALL 51/S/RB7: Pile foundations#(types in terms of: material, diameter, working character, the method of performance; work of single pile and the group of piles; technologies of formation the piles: prefabricated, CFA, large-diameter piles, and others)

ALL 52/S/RB7: Strengthening of weak soils #(concept of weak subsoil; the essence and the purpose of strengthening procedures; strengthening mechanisms; examples of methods using different strengthening mechanisms)

ALL 53/S/RB8: FEM in the 2D bar, beam and truss structures#(local stiffness matrix; degrees of freedom; assembling of global stiffness matrix; solution of the system of algebraic equations – specify the exemplary method of the solution of a system of algebraic equation.

ALL 54/S/RB8: The methods of truss structures analysis #(geometrical stability; methods of analysis e.g. Ritter method, method of joints; zero force members)

ALL 55/S/RB8: Internal forces in the bar structures #(genesis; definition of internal force's; sign convention)

ALL 56/S/RB8: Discuss the course of proceedings and range of calculation relating to the geometry of mass of 2D figures #(gravity centre, first moment of area, moment of inertia and product of inertia; principal moments of inertia at the centroid; moment of inertia for the typical 2D cross sections, e.g. rectangular)

ALL 57/S/RB8: Define the concept „statically indeterminate system"#(the idea of the static scheme; equations of equilibrium, additional constraints).

ALL 58/S/RB3: Design requirements for thermal and humidity protection of external building partitions#(heat transfer coefficient, EP indicator, moisture condensation)

ALL 59/S/RB3: Principles of construction of multi-layer walls#(anchoring layers, ventilation, dilatation, window frames fixing)

ALL 60/S/RB3: Present the construction of a roof covered with tiles over the attic#(thermal insulation, vapor barrier and wind proofing, partition ventilation, rainwater drainage)

ALL 61/S/RB3: List the main types of roof trusses#(construction description, function of structural elements, characteristics of longitudinal stiffening)

ALL 62/S/RB3: Characterize the types of waterproof insulation of buildings suitable for the presence of groundwater#(principles of insulation forming, materials used)

ALL 63/S/RB3: Characterize the cubature and surface parameters of the building#(legal basis, calculation rules)

ALL 64/S/RB7: Road design: Rules of vertical and horizontal alignment#(design speed, circular and vertical curves' parameters; factors affecting designing of the road in profile and on map)

ALL 65/S/RB7: Road pavement construction#(division, description and parameters of every layer, materials, load scheme)

ALL 66/S/RB7: Railway cross section#(draw and name all elements)

ALL 67/S/RB7: Road cross section#(draw and name all elements, cross slopes, dimensions)

ALL 68/S/RB7: Discuss the phenomenon of freezing and the formation of frost heave in the ground; which soils is sensitive to the frost heave; how the phenomenon of frost heave is taken into account in the structure design #

ALL 69/S/RB7: List and briefly characterize the types of shallow foundations#(spread footing, strip foundation, grid foundation, slab foundation, foundation box)

ALL 70/S/RB7: Present the classification of soils#(cohesive and non-cohesive soils, graining of soils, main and secondary fractions)