

Diploma Examination – Questions

(first-circle study)

Questions for the 'Structural Engineering' specialization

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 #.

SE 01/S/RB2: Properties of typical reinforcing steel for concrete structures #(stress-strain diagrams of typical reinforcing steel, hot rolled steel, cold worked steel, yield strength, strain at maximum force, maximum actual yield stress, ductility, rib shapes of reinforcing bars)

SE 02/S/RB2: Ultimate limit states, according to simplify method, in case of elements loaded with: bending moment, compressive force, tensile force#(force distributions, equilibrium of forces, ultimate limit state conditions)

SE 03/S/RB2: Assumptions for verification ultimate limit states in case of shear members#(model and notation for shear reinforced members, the limiting values of $\cot\theta$, ultimate limit states in regions of the member where no calculated shear reinforcement is necessary and in regions where this reinforcement is necessary)

SE 04/S/RB2: Serviceability limit states in case of concrete structures#(types of serviceability limit states, criteria for a serviceability limit state, conditions for serviceability limit states, rules of calculations)

SE 05/S/RB2: Immediate and rheological strains of concrete#(types of strains; conditions affecting the value of creep and shrinkage strain, ways to mitigate its effects)

SE 06/S/RB2: Concrete beams#(static scheme, dimensions of cross section; geometry of reinforcement in case of: simple beam, continuous beam, beams with variable height in the support area)

SE 07/S/RB2: Reinforced concrete beam-and-slab floor#(geometry, static scheme and calculation according to elastic assumptions, reinforcement of floor's elements)

SE 08/S/RB2: Welded connections in steel structures# (types of welds, design requirements, design resistance of welds, connection details, calculation of welded structural joints)

SE 09/S/RB2: Use of plastic reserve of steel strength#(plastic analysis of structures and members - assumptions and requirements, plastic section modulus, plastic hinges etc.)

SE 10/S/RB2: Bolted connections in steel structures#(categories of bolted connections, bolts classes, bolts arrangement and connection details, calculation of bolted structural joints)

SE 11/S/RB2: Design of hot-rolled steel beams and plate steel girders#(examples, bearings and supports, workshop and site joints)

SE 12/S/RB2: Eccentrically loaded single and built-up steel columns#(geometry, calculation and constructional details)

SE 13/S/RB2: Basic safety conditions of building structures according to the limit states given in the standard#(Design procedure using partial factor method. Limit states conditions ensuring the reliability of the structure (ULS and SLS). Design loads and design strength of materials)

SE 14/S/RB2: Types and classifications of actions - definitions, examples#(direct and indirect actions; permanent and variable actions / fixed and free actions, fatigue actions; environmental and technological influences, static and dynamic actions / accidental actions)

SE 15/S/RB2: Combinations of actions in ultimate limit states and serviceability limit states#(fundamental and accidental combination of actions in ultimate limit states; characteristic and quasi-permanent combination in serviceability limit states)

SE 16/S/RB2: Static analysis of reinforced concrete frame structure#(balancing horizontal and vertical loads, envelopes of internal forces)

SE 17/S/RB2: Geometry of elements of precast frame structures#(for example: slabs, beams, columns, foundations)

SE 18/S/RB2: Joints in prefabricated buildings of wall structures # (vertical joints, horizontal joints – examples)

SE 19/S/RB2: Joints between elevation layer and load bearing wall in case of triple prefabricated concrete walls #(constructional detail)

SE 20/S/RB7: Principles of road designing alignment or a profile (designing speed, parameters of horizontal or vertical curve radius, factors determining the course of road in alignment or in profile)

SE 21/S/RB7: Cross-section of railway track (draw a picture and list track components)

SE 22/S/RB7: Cross-section of road (draw a picture and list its components, cross slope, dimensions)

SE 23/S/RB7: Methods for estimating earthwork volumes in linear constructions (assumptions of methods, draw a diagrams of cross-sections)

SE 24/S/RB7: Junctions (classification, junctions geometry types, components)

SE 25/S/RB8: Civil structures definition#(bridges, viaducts, footbridges, wildlife crossings , culverts, tunnels, aqueducts)

SE 26/S/RB8: Bridge structures breakdown#(according to: obstacle type, function, static scheme, material, position and type of a deck)

SE 27/S/RB8: Bridge elements#(substructure – foundations, pillars, abutments and pylons; superstructure – span beams, diaphragms, decks; auxiliary components – barriers, rails, waterproofing, sewage systems, expansion joints, bearings, pavements)

SE 28/S/RB8: Draw three types of arch bridges and show their components #(three positions of a deck: through arch, half through arch, deck arch; arch girder, tie, hangers, deck, columns, diaphragms, bracings)

SE 29/S/RB8: Clearances #(road, railway, navigation; examples and basic dimensions)

SE 30/S/RB8: Supports - types and examples #(foundations, pillars, abutments and pylons; static diagrams and support shapes)

SE 31/S/RB8: Static diagrams of bridges #(beam, rigid frame, truss, arch, cable-stayed, suspension, extradosed)

SE 32/S/RB8: Forming of concrete and steel bridges #(selection of static scheme, division into spans, span depth, geometry of cross section)

SE 33/S/RB8: Auxiliary bridge components #(barriers, rails, waterproofing, sewage systems, expansion joints, bearings, pavements)

SE 36/S/RB5: Stability of bar/beam/column elements under compression load #(buckling mechanism; slenderness ; elastic buckling – Euler's critical load; post-critical buckling)

SE 37/S/RB5: Ultimate limit load #(elasto-plastic model; plastic hinge; plastic redistribution of internal forces)

SE 38/S/RB5: Dynamic loads on structures #(origin, basic characteristics and types of inertia loads – kinematic, strength; inertia loads in structures induced by rotor machines)

SE 39/S/RB5: Discrete systems with many degrees of freedom as structural model with acting dynamic loads #(basic features of the dynamic model against the background of the static model of the structure; forces taken into account in the discrete motion equations; eigenfrequencies and eigenmodes; kinetostatic method of solving dynamic systems; dynamic factor/coefficient)

SE 40/S/RB5: Basic physical models of materials #(Hooke's law; elasticity; plasticity; creep; isotropy; orthotropy; anisotropy)

SE 41/S/RB6: The advantages and disadvantages of timber, their impact on the mechanical strength of timber#

SE 42/S/RB6: Rules of timber design strength determination #(load duration classes, service classes, material coefficients)

SE 43/S/RB6: Methodology of deflections determining for timber beams #(elastic deflection, long term deflection, when we take into consideration the influence of transverse forces on the size of deflections)

SE 44/S/RB6: General rules for calculating metal pin connections in joints with wood or wood-based materials #(general provisions, types of joints damage: single shear joints, double shear joints, timber-timber joints, steel-timber joints)

SE 45/S/RB6: Design rules for timber trusses #(general provisions, shaping rules, buckling lengths, simplified analysis of trusses made with the use of nail plates)

SE 46/S/RB6: Design rules for timber girder of variable cross section or curved axis #(rules for shaping and calculating of girders: single tapered, double tapered, with curved axis, with constant or variable cross section, ridge stresses verification)

SE 47/S/RB6: Theoretical failure model of axially compressed masonry #(Hilsdorf's model; factors having influence on compressive strength of axially compressed masonry)

SE 48/S/RB6: Unreinforced masonry mainly subjected to vertical compression #(ULS conditions for columns and unreinforced walls; columns with bed joint reinforcement)

SE 49/S/RB6: Masonry walls laterally loaded #(ULS conditions for unreinforced external not-loadbearing walls subjected to wind action; simplified design method for cellar wall subjected to earth pressure; external walls being also load-bearing walls)

SE 50/S/RB6: Unreinforced and reinforced masonry subjected to in-plane bending #(ULS conditions; reinforced beams and lintels; deep beams)

SE 51/S/RB6: Overall stability of the masonry building #(methods for adequate overall stability assurance; load-bearing capacity of stiffening walls against horizontal loading (wind action); ULS and SLS conditions)

SE 52/S/RB6: Effects of underground mining exploitation on the terrain surface #(types of subsidence and its causes, parameters describing subsidence of the ground)

SE 53/S/RB6: Principles of shaping of buildings which are subjected to mining deformation of the ground #(static scheme, shape of the building projection, foundations, reduction of structure rigidity by window, door or ceiling openings)

SE 54/S/RB6: Expansion joints in buildings subjected to mining ground deformation #(causes and locations of expansion joints, determination of expansion joint widths, examples of expansion joints solutions in foundations)

SE 55/S/RB6: Determination of internal forces in the foundation framework caused by the effects of area horizontal deformations #(directions of foundation framework loads, types of internal forces occurring in foundation framework, determination of tensile force components, determination of bending moments in continuous footings, reinforcement calculations, arrangement of reinforcement in continuous footings cross-sections)

SE 56/S/RB6: Determination of the ground curvature impact on the infinitely rigid foundation block #(variation in the radius of curvature, changes of stress distribution under the foundation, the limit radius of curvature, additional internal forces)

SE 57/S/RB6: Effect of horizontal ground deformation on building elements recessed in the ground #(distribution of passive, active and mining earth pressure, determination of the deformation disorders zone, methods of the earth pressure reducing)

SE 58/S/RB6: Statistical evaluation of test results or measurements#(estimators for statistical performance evaluation, measurement errors, statistical hypotheses)

SE 59/S/RB6: Movement and force measuring instruments#(mechanical and electro-force strain gauge, bar force gauge, electro-force gauge)

SE 60/S/RB6: Evaluation and diagnostics of reinforced concrete structures#(Schmidt hammer and Capo-Test concrete test method, device for non-destructive reinforcement location)

SE 61/S/RB6: List the facilities of a conventional power plant and discuss one of them #

SE 62/S/RB6: List the facilities of coal mine and discuss one of them #

SE 63/S/RB6: Describe the characteristic elements of the mine lift tower or machine hoisting tower#

SE 64/S/RB6: Describe the classification of tanks for liquid materials#

SE 65/S/RB6: Tanks for loose materials #(basic chamber systems and silo structural elements)

SE 66/S/RB6: Industrial chimneys #(describe the basic design problems for steel and RC chimneys)

SE 67/S/RB6: Tower structures #(basic structural elements of towers and static schemes)

SE 68/S/RB6: Masts #(structural elements of masts and load cases)

SE 69/S/RB6: General rules of the frame structures shaping. Structural details of the frames, calculation rules, reinforcement arrangement #(classification, general rules of the frame structures shaping, structural details of frames: corners, cantilevers, joints; calculation rules and reinforcement arrangement)

SE 70/S/RB6: Crane beams #(general rules for shaping and loading of crane beams; reinforced concrete monolithic and precast beams; structural details)

SE 71/S/RB6: Selected large span roofs – types, general rules of shaping and reinforcement, examples of applications #(arched roofs, bedhead beams and tie-beams; deep-beam structures, single curve shells – cylindrical shells, double curve shells – domes; ruled shells)

SE 72/S/RB6: Tanks – classification, general rules of shaping, calculation and reinforcement #(tanks for liquid materials; tanks for loose materials)

SE 73/S/RB6: General information about prestressed concrete structures#(definition of prestressing, comparison between reinforced-concrete and prestressed-concrete elements, comparison between pretensioning and posttensioning, types of prestressing tendons)

SE 74/S/RB6: Describe the production process of precast, pretensioned concrete slabs and beams#(pretensioning, prestressing bed technology in the precast plants; main structural applications of the precast, prestressed elements)

SE 75/S/RB6: Losses of prestressing force in pretensioned concrete elements#(instantaneous and time-dependent prestressing losses; evaluation of prestressing losses, methods of reduction of prestressing losses, influence of the losses on the prestressing forces)

SE 76/S/RB6: General design rules for pretensioned concrete elements#(allowable prestressing forces, prestressing losses, ULS and SLS criteria in initial, transient and permanent design situations)

SE 77/S/RB7: Designing of foundation footings#(foundation depth, shapes of footings: square, rectangular, socket, dimensions of footings)

SE 78/S/RB7: Designing of the reinforcement of foundation footing#(model of the reinforcement behaviour, calculation of the force taken by the reinforcement, selection of the type and number of reinforcement rods)

SE 79/S/RB7: Active and passive pressure acting on the retaining structure#(change of pressure with depth, water pressure, change of pressure in the case of a stratified subsoil)