

Example of Issues engineering exam
SUSTAINABLE BUILDING ENGINEERING

CIVIL ENGINEERING

1. Shallow and deep foundation (Direct and indirect foundation) of buildings? Factors influencing the depth and method of foundation of buildings.
2. Technology of construction of a block and beam (ribbed) floor on a selected example?
3. Classification of floors (ceilings) , examples.
4. Function of a ring beam and lintel in a building?
5. Masonry structures – loads, e.g. pillars
6. Types of stairs due to material and structure (sketches)
7. Roof trusses (structure, sketches)
8. Flat roofs – types and structure.
9. Green roof – arrangement of layers, traditional roof and inverted roof?
10. Floors and floorings, classification, selection of layers, parameters
11. Damp-proof, vapor-permeable and vapor-tight insulation – example solutions, layer arrangements (waterproofing/waterproof/water insulation)
12. Drainage of buildings and structures

SUSTAINABLE BUILDING

1. Buildings standard NF 40 and NF 15, idea? Energy efficiency and passive building
2. Thermal bridges - classification, methods of elimination
3. Thermovision, idea, application (thermal imaging advantages and disadvantages conditions of use)
4. Energy certification (including multi-criteria), example
5. Heating ceilings / heating floors
6. Use of BIM technology in construction, (standards, examples, model preparation)
7. Renewable energy sources, examples

BUILDING PHYSICS

1. Transport and exchange of heat and moisture in building materials
2. Moisture and diagnostics in buildings: causes, research methods,
3. Waterproofing of buildings (materials, primary and secondary methods)
4. Thermal insulation of buildings (requirements, parameters, methods), ETICS system etc

CONSTRUCTION MATERIALS

1. Technical characteristics of building materials
2. Natural stone materials
3. Building ceramics
4. Mineral building adhesives + EN 197-1
5. Binders and materials for damp proofing, waterproofing and roof waterproofing
6. Wood (types, uses, properties, causative agents and types of biological corrosion), wood construction products
7. Aggregates (natural, heavy and light)
8. Plastics (general knowledge, constituents, properties, plastic building products)
9. Construction glass (general knowledge, properties, technical characteristics and uses of different types of glass)
10. Thermal insulation materials (types, uses, properties).

CONCRETE TECHNOLOGY

1. Classification of cements, application
2. Class of concrete, factors affecting compressive strength of concrete
3. Exposure classes of concrete
4. Concrete additives and admixtures. Examples and application
5. Concreting in winter and high temperature conditions
6. Methods of designing concrete composition

INDUSTRIALIZED CONSTRUCTION

1. Forms for the production of precast concrete elements.
2. Types of precast concrete plants.
3. Contemporary prefabrication (modern solutions)
4. Forming and sliding devices (climbing formwork)

STRENGTH OF MATERIALS

1. Internal forces in beams and frames
2. Geometric characteristics of figures
3. Strain, stress and displacement states
4. Tension, compression, shear and bending of bars
5. Free torsion
6. Skew bending and neutral axis of the cross-section
7. Eccentric action of force and cross-section core
8. Experimental methods of testing displacements and stresses
9. Experimental tests of materials, tensile testing of metallic materials
10. Methods of calculating deflections in beams
11. Stability of a prismatic bar

STRUCTURAL MECHANICS

1. Calculation of forces in truss members.
2. Determination of displacements in statically determinate systems - various external influences.
3. Determination of displacements in statically indeterminate systems.
4. Buckling lengths of members under compression.
5. Transformation formulas (slope-deflection formulas) of the stiffness method.
6. Influence lines in beams.
7. Solving of statically and / or kinematically indeterminate systems.
8. The dynamic degrees of freedom of structures with a discrete (point) mass distribution.
9. The natural frequencies and modes of vibrations in beams and frames.
10. The phenomenon of resonance and methods to avoid its occurrence.
11. The matrix version of the stiffness method applied to beams.

CONCRETE STRUCTURE

1. Assumptions of ultimate limit state when calculating reinforced concrete sections under bending with or without axial force.
2. Serviceability limit states in reinforced concrete structures.
3. Ultimate limit state - bending (cross sections of any shape, rectangular sections, T-sections).
4. Shear in reinforced concrete based on a truss model.
5. Taking into account geometric imperfections at the cross-section, element and structure level in calculations.
6. Cracks in reinforced concrete structures.
7. Principles of calculating and designing direct foundations.
8. One-way and two-way reinforced concrete floors.
9. Principles of calculating and detailing of reinforced concrete stairs.
10. Retaining walls. Ultimate limit states of the structure and soil.

STEEL AND TIMBER STRUCTURES

1. Fire protection of steel and timber structures
2. Protection of steel structures against corrosion
3. Methods of protecting timber against biological corrosion.
4. Connections in steel and timber structures
5. Resistance of the steel and timber cross section
6. Resistance of steel and timber elements
7. Bracings in steel and timber structures
8. Principles of the dimensioning of steel and timber elements: beams, columns, and trusses
9. Physical and mechanical properties of steel and timber
10. Buckling of a steel and a timber element
11. Lateral-torsional buckling of a steel and a timber element

CONSTRUCTION ENGINEERING MANAGEMENT

1. Types of cost estimates, their functions and contents. Basics of preparing cost estimates
2. Simplified method vs. detailed method of cost estimate calculation
3. Investor cost estimate in public works contracts
4. Critical path method in planning.
5. Methods of organizing work. Advantages and disadvantages of methods
6. Types of construction schedules

7. Components of construction site development
8. Distribution and complex method of assembly of building structures
9. Basic tools of Quality Management
10. Basic principles of the execution of masonry structures
11. Concrete works. The pressure of the concrete mixture on the formwork
12. Masonry and concrete works in winter conditions
13. Earthworks, balance of earth materials. Types of excavations and their protection
14. Division of floors, technology of making filigree floor.
15. Basic parameters of assembly machinery. Types and principles of selection of assembly cranes.

COMPUTER ANALYSIS

1. Discuss the basic principles of construction technical drawing
2. Discuss the applications of systems of linear equations in civil engineering
3. Discuss the applications of linear optimization in civil engineering
4. Discuss the applications of differential equations in civil engineering
5. Algorithm of the finite element method for truss structures
6. Algorithm of the finite element method for beam/frame structures
7. Finite element method equation for linear static problems and interpretation of stiffness matrix components
8. Differences between truss and beam finite elements
9. Limitations of the truss finite element in linear statics
10. Limitations of the beam finite element in linear statics
11. Advantages of using BIM technology
12. Discuss BIM standards
13. Discuss the rules for proper BIM model development
14. Discuss the critical aspects of BIM
15. Discuss the supporting BIM tool

ROAD ENGINEERING

1. Basics of road design
2. Elements of ground structures for road pavements
3. Classification of single- and multi-level road intersections
4. Classification of road pavements
5. Pavement design methods according to catalogs of typical road pavements
6. Materials used for road construction
7. Earthwork technology
8. Road pavement technology
9. Measuring instruments for assessing the condition of road pavements
10. Road maintenance

BRIDGE CONSTRUCTION BASICS

1. Basic definitions related to bridge engineering
2. Structural members of bridge superstructure
3. Fittings of bridge structures
4. Bridge substructure
5. Arrangement of beam-and-plate bridge spans
6. Methods of bridge structures erection
7. Static analysis of beam-and-plate composite bridge spans
8. Strength analysis of a steel-concrete composite girder

RAILWAY CONSTRUCTION

1. Categorisation, classification and typisation of railway lines and railroad tracks
2. Railway horizontal curves: centrifugal force, tilt, minimal and optimal parameters, transition curves, tilt ramps, curves with decreasing radiuses
3. Railway vertical alignment: maximal and energy consuming grades depending on line's category or type, niveleta design, vertical curves
4. Railway motion resistance, equation of motion, motion calculations
5. Railroad's cross sections, methods for building excavations and embankments, subgrade's drainage
6. Railroad balasted and balastless tracks: advantages, disadvantages, comparison, track type choice
7. Classical and CWR railroad track: elements of such track, cooperation between elements

8. Methods of main repair of railroad tracks
9. Factors influencing work of a railway track during its exploitation
10. Maintenance process of a railroad's superstructure and subgrade, geometrical evaluation of railroad's track's state

SURVEYING

1. National spatial reference system, Gauss-Krueger projection
2. Rectangular coordinate systems: "2000", "1992", "1965"
3. Base map databases
4. Land and building registry
5. Horizontal and measurement geodetic network
6. Height and measuring geodetic network
7. Methods of measuring details of situational and height
8. Geometric leveling on the construction site
9. Tacheometry as a method of spatial measurements
10. Basic principles of engineering measurements

GEOTHECNICAL

1. Surface mass movements
2. Soils (thixotropy, freezing, suffosion, liquefaction)
3. Forms of glacial and fluvioglacial accumulation
4. Exogenous processes
5. Water in vadose (aeration) zone and phreatic (saturation) zone
6. Direct foundations depth criteria
7. Basic physical soil parameters, define and describe
8. Mechanical soil properties, define and describe
9. Settlements and consolidation, define and describe differences
10. Types of retaining structures