



The Minimal Elements of Qualifications Standard

1. BASIC CHARACTERISTICS

1.1 Name(s) of qualification (generic + subject specific)

Bachelor of Civil Engineering - Civil Engineer;

1.2 Minimal volume

180 ECTS

1.3 Level

six (6)

1.4 Entry routes

Completed four-year secondary school

2. COMPETENCIES / LEARNING OUTCOMES

2.1 List of competencies at the level of qualification

- Recognise, identify, describe and solve technical problems in civil engineering taking into account moral principles.
- Design buildings at basic level.
- Size small building structures in civil engineering construction, hydraulic engineering and building construction.
- Manage a small construction project.
- Participate in planning, design, execution, supervision and maintenance of large construction projects.
- Use common computer-aided tools to develop documents, presentations, and to perform calculations and simulations.
- Recognise the interaction between design, construction and user requirements.
- Prepare and perform an experiment, and analyse and interpret its results
- Critically evaluate arguments, assumptions and data in decision making, and creatively solve technical problems.
- Understand the impact of civil engineering on society and the environment.
- Communicate and share information and ideas about problems related to civil engineering with appropriate civil engineering professionals and other professionals.
- Cooperate in technical groups and adapt to the requirements of the work environment.
- Understand the impact of civil engineering on society and the environment, and have a clearly developed moral and ethical approach to solving technical problems.
- Prepare and perform an experiment, and analyse and interpret its results.

- *Independently improve and further develop competencies acquired during education, including options for active participation in specialist professional conferences*

2.1 Learning outcomes

(organised in Units of learning outcomes and other groups/modules, where Units have additional information, e.g. ECTS)

○ **Mathematics and Physics (min 30 ECTS)**

- Understand and apply basic and advanced concepts of analysis, algebra and numerical mathematics required for modelling and optimisation and for solving practical engineering problems;
- Assess the quality of obtained solutions, their practical applicability and feasibility, and the monitoring of their implementation;
- Describe, understand and apply basic concepts of probability and statistics as well as advanced methods required to solve and describe technical problems.
- Describe and analyse basic laws of physics in areas discussed in lectures, and practically apply this knowledge to solve simple problems and tasks, focusing on matters that facilitate acquisition of knowledge in technical subjects
- Evaluate and apply basic knowledge in spatial geometry, developing projections with associated 2D and 3D visualisations applicable in practice;
- Describe examples of non-methodological approaches to descriptive statistics and probabilistic analysis; distinguish error assessment methods; test hypotheses, etc. in the construction domain.

○ **Foreign Language (min 3 ECTS)**

- Communicate (read, write, speak) in a foreign language, on general and professional levels.

○ **ICT (min 6 ECTS)**

- Develop independent programming solutions to mathematical problems in one of the programming languages
- Use basic knowledge and use software packages for drawing
- Apply computers in structural design and analysis

○ **Theory of Structures I (min 30 ECTS)**

- Distinguish and analyse the underlying theoretical laws of statics as a part of mechanics and define transverse forces of statically determinate structures.
- Describe and analyse theoretical laws in point and rigid body kinematics and dynamics, as well as fundamental concepts of the theory of oscillations for systems with one degree of freedom.
- Comment on and analyse the theory of stress, strength and stability of engineering structures. Calculate and size simple statically determinate and statically indeterminate structures.
- Solve various problems in the mechanics of a solid deformable body.
- Describe geometric invariance and laws of kinematic stability of linear structures.
- Define, analyse and calculate the statics of line and plate structures, and of walls and rocks.

- **Building Structures I (min 12 ECTS)**
 - Distinguish and describe the main stages of the historical development of civil engineering
 - Analyse and develop parts of the main and final architectural design for a simple building.

- **Construction Materials (min 10 ECTS)**
 - Distinguish main construction materials and their properties
 - Examine properties of construction materials
 - Design and perform an experiment, analyse and interpret the data

- **Theoretical and Applied Hydromechanics (min 4 ECTS)**
 - Comment on stationary motion of fluids, hydraulics of open watercourses and groundwater.
 - Produce small engineering calculations of flows in pipelines, canals and water intakes

- **Geology and Geotechnics (min 6 ECTS)**
 - Describe soil properties required for calculation.
 - Produce bearing capacity calculation for foundations, settling, consolidation, slope stability and soil pressure on support structures.
 - Describe and analyse the structure of the Earth, in particular the lithosphere; distinguish processes and phenomena on the surface of the lithosphere; comment on the origin of earthquakes, volcanoes and orogeny.
 - Describe basic concepts of load calculation and sizing of geotechnical structures (retaining walls, bulkheads, construction pits, excavations and embankments).
 - Size shallow and deep foundations

- **Theory of Structures II (min 5 ECTS)**
 - Describe dynamic properties of structures.
 - Produce dynamic calculation of simple structures according to the applicable Regulation for High Rise Buildings in Seismic Areas.
 - Participate in the development of dynamic calculations of simple buildings.

- **Building Structures II (min 30 ECTS)**
 - Develop in detail classic reinforced concrete structures.
 - Size sections subjected to bending, shear and torsion, thin pressed elements, biaxial bearing plates, point supported plates.
 - Determine the condition of cracks in sections in usable condition
 - Describe basic theoretical concepts in structures made of various materials (concrete, wooden, metal and masoned)
 - Size sections, connections and extensions in simple structures
 - Design systems, components or processes for design purposes, taking into account economy, environment, social, political, health and safety elements, as well as sustainability.

- **Utilities and Process Hydraulic Engineering (min 5 ECTS)**
 - Explore and assess functions of water supply and sewerage systems and their elements
 - Select the best option in the process of planning, design, construction and management of water supply and sewerage systems and their functional elements.

- **Hydraulic Structures and Facilities (min 4 ECTS)**
 - Review and explore main functions of hydraulic structures, their main support processes, and use basic methods in design and construction of hydraulic structures.

- **Hydrology and Water Management (min 4 ECTS)**
 - Explore and analyse components of the hydrological cycle
 - Apply mathematical and statistical methods to solve engineering-hydrology problems.
 - Develop elementary hydrological calculations in hydraulic engineering.

- **Roads (min 3 ECTS)**
 - Describe, analyse and argue design and construction procedures for railroads.
 - Classify main elements of railways, as well as the methods of planning, design and maintenance.
 - Design a road project outside a human settlement up to the level of a concept design, including full appreciation of requirements for selecting optimal elements (geometry, route).

- **Geodesy (min 3 ECTS)**
 - Distinguish and use plans and maps
 - Perform essential geodetic operations such as angle measurement and detailed levelling.

- **Construction Organisation (min 4 ECTS)**
 - Distinguish the fundamental principles and methods of organisation, planning, management and execution of construction projects.
 - Comment on legislation that governs contracting and execution of construction projects.
 - Develop and implement a project for construction organization and plans in practice.

- **Economics and Law (min 3 ECTS)**
 - Describe and define the following: market principles; laws of supply and demand; economic organization of enterprises; entrepreneurship.
 - Distinguish costs, analyse operating results in production and determine performance criteria.
 - Extending the knowledge necessary to understand the impact of engineering solutions on the global, economic, social and natural environment

○ **Professional Practice (min 3 ECTS)**

- Describe, analyse and critically assess options for solving a particular practical problem.
- Communicate and work in a multidisciplinary team
- Confirm one's professional and ethical responsibility
- Recognize the need for lifelong learning

3. RELEVANCE

3.1 Labour market

- *Positions of a site manager;*
- *Associate designer in an engineering office;*
- *Associate in administrative bodies (urban planning, inspection departments);*
- *Teacher in a secondary school for civil engineering-architecture (subject to the passing of pedagogical examinations)*

3.2 Further education / progression

- *Further education at the 2nd cycle in an appropriate programme*

3.3 Other needs

4. QUALITY ASSURANCE

4.1 Working group members

UISA: prof. dr Mitar Perušić

UISA: prof. dr Goran Tadić

UNBI: prof. dr Ifet Šišić

UNBL: mr. Bojana Grujić

UNMO: prof. dr Dragi Tiro

UNSA: doc. dr Naida Ademović

UNTZ: prof. dr. Sandira Eljšan

UNTZ: prof. dr. Suad Halilčević

UNZE: prof. dr Edin Berberović

UNMO: prof. dr Vahida Žujo

UNBI: prof. dr Atif Hodžić

5. Criteria for the Qualification Awarding Institution

The institution must meet all the requirements set forth in the Law on Higher Education, as well as any applicable norms and standards.

Additional instructions:

In developing the qualifications standard, comparisons were made with universities in the region: Zagreb, Belgrade and Vienna, as well as the University of Kentucky, Department of Engineering, USA