**COMPULSARY EXAM**

**BRIDGES AND STRUCTURES**

**(Civil Engineering BSc, Structural Engineering Specification)**

**2020/2021.**

Brief answers explained by drawings and explanatory figures are expected.

1. What type of aboutments do you know, what are the fundamental differences among them? Sketch the cross-sections of two typical aboutments with different systems. Name them and describe their parts. Introduce and draw the possible design, foundations, the static frame of pile and wall systems of abutments.
2. What is the role of bridge bearings? Introduce the factors that have to be considered when designing a bearing. Sketch two steel bridge bearings with different degrees of freedom. Introduce the design of rubber bearings, describe the manners of deformation!
3. What is the purpose of dilatation? Introduce the factors that have to be considered when selecting a dilatation? Describe at least three different types of dilatation.
4. What is the purpose of the approach slab? What are the so called secondary elements on a bridge? Give examples. What is the wing wall, what is its purpose and what geometries do you know?
5. Describe the longitudinal beam and a cross beam system. Introduce the possible junctions of a longitudinal beam and a cross-beam. Why is spatial stability of a steel bridge necessary and how can it be implemented? What type of bracings, struts do you know?
6. What type of arch bridges can you identify on the basis of their statical system? Describe the load bearing mechanism of each type.
7. What is an orthotropic plate? Introduce and describe the possible geometries of ribs on an orthotropic plate. What is the main advance of an orthotropic plate and what is its main risk?
8. What are suspended bridges? Describe their typical implementation, their load bearing elements and their load bearing system. Describe the structural elements!
9. What are integral bridges? Describe their typical implementation, their load bearing elements and their load bearing system. Describe the structural elements!
10. Introduce and describe in-situ concrete beam and a plate bridges. Illustrate typical cross-sections. Show up the implementation of common and/or possible reinforcing geometries.
11. On the basis of which aspects can tensioning be grouped in concrete construction? Describe the steps of pre-tensioning and post-tensioning. What are tension losses? Describe the elements of Freyssinet’s post-tensioning system and the steps of carrying out tensioning. Describe the phenomenon of anchoring breakage and detail the countermeasurements required.
12. On the basis of which aspects can tensioning be grouped in concrete construction? Describe the steps of pre-tensioning and post-tensioning. What are tension losses? Describe the elements of Dywidag post-tensioning system and the steps of carrying out tensioning.
13. Introduce the alignment of tensioning cables. Which two alignments are common in bridges? What cable types are suitable for these?
14. List and describe the possible building technologies of stressed concrete bridges, describe the state-of-the art building methods. Detail launched and cantilever bridge-building technologies. How are these technologies applied with steel bridges?
15. Introduce ribbed reinforced concrete bridges. Detail their advantages and disadvantages. Describe the design of ribbed reinforced concrete structures.
16. Introduce cable-stayed bridges, their statical system, their members, possible column geometries, cables, nad cable geometries.
Detal the construction of cable-stayed bridges, construction states, the static of each state. What made quick evolution of cable-stayed bridges of possible?
17. What do we call an composite bridge? What are the typical parts of it? Describe the characteristic of each component of an composite bridge considering their advantages and disadvantages. Describe the forces acting on composite connections and the possibilities for the implementation of such connections.
18. What is load testing of bridges? What is its aim? How can load testing of a bridge be carried out? Introduce the levels of a bridge examination and its expected frequency.