Final Examination Topics for
Hydrogeologist Engineer Master Students

Hydrogeology and Water Mining

1. What is the definition of the aquifer? What are the principal aquifer rock types? Please give examples for the values of hydraulic conductivity in case of different rock types. What is the definition of the storage coefficient? What kinds of aspects or considerations belong to the terms of sustainability?
2. What is hydrogeology? Please describe the Darcy-equation and its components. What are the elements of hydrologic cycle? Please describe the global hydrological (water budget) equation. How does artificial recharge work in reality? Which regions can be suitable for this method?
3. What is the definition of groundwater basin? Please describe the Hubert's model and the Toth's flow model. Please describe the local, medium and regional flows in a basin. Please describe the Ghyben-Hetrzberg equation in case of sea water intrusion. How can this phenomenon jeopardize drinking water supply in coastal regions?
4. Please describe the main steps of the Theis pumping test evaluation. Please give the main equations with the well function. What is the meaning of recovery data in well hydraulics? Why can experts prefer field data to laboratory data concerning the hydraulic conductivity?
5. What is the importance of transboundary aquifers? Which is the more preferable position in case of water management? Downstream side or upstream side? Drinking, mineral, medicinal and thermal water resources and their utilization from aquifers. Please give the basic definitions. How can geothermal gradient and heat flow be defined? What is the relationship between hydrogeology and geothermal energy utilization?
6. Please describe the main properties, features and aspects of karst aquifers? What kinds of methods are existing in karst investigations? Please give information about hydrograph analysis. What are the main processes of karstification? What kind of distributive methods can be used in karst modeling?
7. Please describe the isotope hydrology techniques in groundwater investigation. Please give the most important radioactive and stable isotopes in hydrogeology. What are the

methods for groundwater age dating? How can you estimate the groundwater recharge with environmental isotopes in the unsaturated and the saturated zone?

8. Surface water utilization possibilities. Definitions, types, application, advantages - disadvantages.
9. Springs and springwater utilization. Definitions, classification possibilities of springs, springwater utilization types, application, advantages - disadvantages. Introduction of an artificial gravity spring captation in details.
10. Boreholes and wells. Definitions, types, classification possibilities, advantages - disadvantages.
11. Well design - necessary basic information, determination of the expected geology, principles, and the main parts and their roles of the well.
12. Well design - construction order of a three-casing-well (standpipe, inner casing, filter pipe), the role and the construction of the main elements (packed joint, gravel pack, steel shoes, bottom plate, grouting).
13. Well design - Necessary calculations, drilling- and pipe sizing, pipe materials. Differences between a water production well and a dewatering well.
14. Classification of drilling techniques (basis for classification, benefits, limitations). Introduce one selected drilling technique (principle of operation, applicability, equipment, pros and cons, etc.)
15. Types/classification of well screens. Physical and chemical stressors on well screens, basic principles for screen design. Requirement of graveling.
16. Rotary mud drilling (introduction, types, benefits, equipments, accessories). Roles of the slurry.
17. Physical and chemical properties of the rotary drilling mud (functions of the mud, benefits, limitations, on site lab tools)

Groundwater Prospecting, Water Management and Geotechnical Engineering

1. Shallow porous groundwater resources, bank-filtered water resources (geological formations, static and dynamic resources, elements of the water budget, utilization, sustainability, water management problems)
2. Deep porous groundwater resources, karstic and fissured groundwater resources (geological formations, static and dynamic resources, elements of the water budget, utilization, sustainability, water management problems)
3. Global problems in groundwater management, Groundwater protection (basic ideas of protection, active and passive protection problems, protection zones, protected and vulnerable resources)
4. The basics of groundwater exploration (the purposes, the basic theories, the type of methods)
5. Gaining hydrogeological information in groundwater exploration (its tools and methods, surface measurements, measurements in observation wells, evaluation of the results)
6. Application of surface geophysical methods in GW exploration (resistivity methods, DC, IP, GPR, MT, seismic, gravity)
7. Application of borehole logging in GW exploration (methods in borehole, interpretation, aquifer identification)
8. Application of well logging (methods can be used in a cased well, well inspection logging, interpretation)
9. Subsurface exploration (drillings, soil sampling, groundwater exploring boreholes, well types, well testing and its results)
10. Basic characteristics of soils (soil as a three-phase system; consolidation characteristics of soils; shear strength of soils)
11. In-situ testing of soil (geotechnical preparatory activity; datacollecting; soil invetsigation methods; main geotechnical documentations)
12. Basics of geotechnical design (general characterization of EuroCode; limit states; design methods; characteristic value; design value; partial safety factor)

13. Stress fields in soil, earth pressures (geostatic earth pressure; Rankine's earth pressure theory; earth pressures as a function of wall movement)
14. Shallow foundations (types of shallow foundations; design process of shallow foundations; settlement of shallow foundations; bearing capacity of shallow foundations)
15. Deep foundations (types of deep foundations; deep foundation technologies)
16. Stability of self-supporting soil masses (types of slope movements; factors influencing stability; stability testing methods)
17. Retaining structures (types of retaining structures; design of retaining structures; stresses around retaining structures)
18. Geosynthetic materials (its type, application, functions for each type, important properties and its qualifications testing)
19. Geotechnical aspects of landfill sites (subsoil requirements, testing methods, bottom and cover liner systems, alternative materials)
20. Geotechnical aspects of contaminated site investigation and remediation (special tools in investigation, sampling methods, barriers in remediation, design aspects of barriers)