**Comprehensive Geotechnics Exam**

**(2020, Autumn Semester)**

1./

A./ Particle Size Distribution Test. Parameters of the Curve. Sedimentation Test (Hydrometer analyses).

B./ Describe uncertainty and how engineering practice handle it. Eurocode, standards, design procedure.

C./ Unequal settlements. (what causes, case study examples)

2./

A./ Soil investigation and exploration. (planing the locations and depth etc.) Direct soil explorations. (boring, open pit exploration, sampling)

B./ Excavations (narrow and wide) and their support (drawings).

C./ Bearing capacity of piles using static method. Calculating the shaft (side) resistance.

3./

A./ Indirect soil explorations. (Penetration Tests). In situ tests.

B./ Earth pressure using Coulomb method. (plane failure surface). The effect of the surface load.

C./ Prefabricated piles (timber, steel, concrete, MEGA piles). Pile driven methods and technologies.

4./

A./ Phase relationships. (volume, mass ratios).

B./ Reinforced earth (Vidal retaining wall). Soil nailing, and anchored walls.

C./ Defining the bearing capacity of piles from loading test and from penetration tests.

5./

A./ Compaction. (Proctor Test). Relationship between the water content and compaction.

B./ California Bearing Ratio, Plate Loading Test. Compaction technologies and equipments. Quality control of earthwork projects.

C./ In situ pile technologies (general introductory, Continuous Flight Auger, Franki)

6./

A./ Index Tests and Classification. Classification of soil and the related soil parameters.

B./ Diaphragm wall (slurry wall). Design and technology. Water proof sheet pile support.

C./ Classification and the materials of the foundations. Classification of deep foundations.

7./

A./ Shrinkage and swelling. Prestress, Identification, OCR.

B./ Factor of safety at slope stability investigtions.

C./ Foundations on “problematic” soil, like shrinking and swelling clay, soil with high organic content etc.

8./

A./ Stress in the soil. Total, effective and neutral stress. Calculating the overburden pressure (vertical stress).

B./ Slope stability investigation using the friction circle method.

C./ The undrained bearing capacity of shallow foundations according to EC 7.

9./

A./ Two-dimensional state of stress (plane stress). Mohr’s circle.

B./ Describe the lateral earth pressure (active, passive, at rest). The relation between earth pressure and displacement/deformation. Over consolidation.

C./ Settlements (cause, saturated soil, consolidation, wetting induced collapse).

10./

A./ Mohr-Coulomb failure criterion. Lateral earth pressure at rest.

B./ Basic assumption of soil failure. Special cases of soil failure (fi=0; or c=0). Slope stability investigation in granular (c=0) and fine grained soil with no internal friction (fi=0).

C./ In situ pile (SOIL-MEC, VUIS, micro, highway), and jet-grouting technologies

11./

A./ Defining the shear strength parameters of the soil. (Direct shear test, uni axial and triaxial tests)

B./ Define active earth pressure using combined plane and circular failing surface.

C./ Stress distribution under elastic and rigid shallow foundations.

12./

A./ Groundwater and soil interactions. Hydraulic conductivity. Darcy’s law.

B./ Dewatering general description. Horizontal drainage (sump pumping)

C./ What factors influence the bearing capacity of shallow foundations?

13./

A./ Determining the hydraulic conductivity (laboratory + field tests + empirical).

B./ Single, two stage well-points, deep-wells. Design and technology.

C./ Preventing unwanted settlements. Settlement limits of structures and the parameters defining these limits.

14./

A./ Hydraulic heave and its prevention. Liquefaction of soils.

B./ Water cut off, water proof solutions of dewatering.

C./ Concepts for designing the height of the shallow foundation. Simplified method.

15./

A./ Capillarity in soil. Frost in soils.

B./ Dewatering of slopes and retaining walls. Drainage systems. Filter design.

C./ The drained bearing capacity of shallow foundations according to EC 7.

16./

A./ Soil deformations. Oedometer test.

B./ Lateral earth pressure in braced cuts. Design and technology.

C./ Settlement calculations/predictions.

17./

A./ Consolidation and its changing in time.

B./ Retaining walls. Gravity walls and their design, including cantilever walls.

C./ Stress distribution in elastic half-space. Simplified methods calculating the stress distribution under the foundation.

18./

A./ The formation of the loess soil. Wetting induced collapsibility.

B./ Slope stability - method of slices. Influence of water, and earthquakes.

C./ Principles of earthquake design.

19./

A./ Ground water and related geotechnical problems.

B./ Geo-synthetics, types, functions, and applications in geotechnics.

C./ Choosing the depth of the foundation. What are the requirements and contributing factors?

20./

A./ Soil mechanics investigation reports and its contents including the drawings (site plan, borehole log, cross section etc.).

B./ Probability. Normal (Gauss) distribution and its parameters. How the characteristic value of soil mechanic parameters is calculated?

C./ Well and caisson foundations.