Department of Geology
University of Pretoria

ENGINEERING GEOLOGY GLY 363

SEMESTER TEST MEMORANDUM

11 March 2010

Question 1

1.1

[25]

Engineering geology is about those soil and rock properties that may influence infrastructure development.

1.1 Discuss the four most important parameters that will determine the rock and/or soil material properties and list at least one test method to determine each of these properties. (12)

Strength – mechanical properties – UCS/PLS, etc

Deformation – applied stress leads to change in volume/shape – during applied load tests (UCS)

Permeability – water loss, water inflow, reduce shear strength – lab/field (packer)

Durability – resistance to abrasion/chemical change – mineralogy, sulphate soundness. etc.

1.2 The way in which soil or rock will respond to changes in stress conditions may be deduced from the so-called ground model. Explain the concept of the ground model. (9)

Strength +deformation + permeability + durability = material properties (mineralogy)

Material properties + mass fabric (discontinuities/bedding, etc.) = mass properties

Mass properties + environment (weathering type) = ground regime

Ground regime + imposed change (structure, tunnel, etc.)= ground response

1.3 Why do you think is it very difficult to predict the behaviour of earth materials in general. (4)

Mineralogy & texture, weathering processes, soil forming (time) influence end products. Small variations in geological processes will lead to heterogeneous properties.

Question 2 [18]

Discuss and explain the following:

2.1 core stone development and associated engineering problems (10)

igneous rock, jointed, chemical weathering, weathering along joints and horizontal sheeting, joint intersections largest surface area most weathering, soil matrix with fresh rock boulders, rounded at top, excavation difficulty with soft soil and large corestones, differential settlement across soil-corestone contact.

2.2 reasons for varying depth to bedrock in Ventersdorp Andesite (8)

igneous rock; cooling reduce volume; jointing; tectonic joints; varying joint spacing; decomposition; deeper weathering @ closely spaced joints; shallower bedrock @ widely spaced joints

Three different climatic regions:

Semi-arid (N > 5) - shallow bedrock; thin soil cover

Semi-humid (N < 5) - medium depth; expansive clays

Sub-humid (N < 2) - deeply weathered; compressible clays

Question 3 [12]

Name and explain the major differences between the engineering geological properties of argillaceous rocks and arenaceous rocks. (Suggestion: tabulate your answer).

	Argillaceous	Arenaceous
Strength	weak (weak minerals - clays)	Strong - hard mineral quartz - cemented
Deformation	P-PE - deform easily	E-PEP - compress cement 1st
Permeability	low impermeable clays	High in sandstones; low in quartzites
Durability	Low (clay minerals)	High (quartz)
Weathering	easily	Only physical
Slopes	Unstable on smooth bedding planes	Unstable when dipping & undercut
Construction	When indurated use as tiling	Good aggregate

TOTAL **[55]**

Bonus question:

What does a pedocrete comprise of? [5]

Parent material (existing soil) + authigenic cement (Fe, Mn , Ca, Si)

Rearrangement of materials in soil profile.