



UNIVERSITY OF MINES AND TECHNOLOGY, TARKWA

FIRST SEMESTER EXAMINATIONS, DEC, 2018

COURSE NO: GL 353

COURSE NAME: SOIL AND ROCK MECHANICS

CLASS: GM III

TIME: 3 Hours

Name: _____ Index Number: _____

Question 1-10

State whether the following statement is True or False

- 1 The porosity of a soil can be more than 100%
- 2 The specific gravity of particles of coarse-grained material is greater than 2.7.
- 3 The sedimentation test cannot be used for particle size larger than 2mm.
- 4 The plastic limit is the water content of soil at boundary between the plastic state and the semi-solid state.
- 5 Air exists only in partially saturated soils and dry soils
- 6 Stress is normally considered to be comprehensive in nature
- 7 Young's modulus is a physical constant parameter
- 8 Property of volume increase under loading is regarded as dilatancy
- 9 Minor stress has the smallest tensile magnitude
- 10 In direct shear test both frictional angle and cohesive strength of the rock can be obtained.

Question 11-20

Choose the correct answers from the following

11. A rock core from a borehole BHID-4 has length of L m and only $2x$ m is above 100mm, what is the rock quality designation (RQD)

- (a) $RQD = \frac{2x * 100}{4L}$
- (b) $RQD = 3 \frac{x}{L} * 100$
- (c) $RQD = 2x * \frac{100}{L}$
- (d) $RQD = 4x^2 * 100L$

12. Relevant properties of intact rock include all except

- (a) Shear strength
- (b) Tensile strength
- (c) Cassagrade's Test
- (d) Slake durability Test

- 13 The uniaxial compressive strength of quartzitic rock gave 250MPa. Given that the rockmass rating of the material was 85, use the necessary applications to determine the Q-index of the rock.
- (a) 85.1
 - (b) 74.3
 - (c) 100.4
 - (d) 95.6
- 14 For a rock sample of 15cm long with uniaxial compressive strength of 100MPa, the Young's modulus if deformation is 3mm.
- (a) 2×10^4
 - (b) 2×10^5
 - (c) 5×10^4
 - (d) 5×10^5
15. The permeability of soil varies
- a) square of grain size
 - b) Inversely as square of grain size
 - c) as grain size
 - d) inversely as grain size
16. The density at which the soil neither dilates nor contracts during deformation is known as
- a) ultimate density
 - b) standard density
 - c) critical density
 - d) absolute density
17. Which of the following test would be required if a soil contains more than 5% fines.
- a) wet sieve analysis
 - b) dry sieve analysis
 - c) sieve analysis
 - d) chemical analysis
18. With an increase in the liquid limit, compression index
- a) increase
 - b) decrease
 - c) remain constant
 - d) may increase in decrease.
- 19 Longitudinal splitting in uniaxial compression direction could be described as
- (a) sliding
 - (b) slabbing
 - (c) spalling
 - (d) shedding
- 20 A state of strain resulting from stress condition most easily described by a Mohr Circle centred at the origin is regarded as
- (a) pure strain
 - (b) pure shear
 - (c) pure stress
 - (d) pure modulus

SECTION B: Attempt any two Questions out of the following

Que 1

- (a) Briefly distinguish between the following:
 - (i) Drained and Undrained test
 - (ii) Shear stress and Residual stress
- (b) Mention two each of laboratory and *in-situ* shear test methods
- (c) A shear box test on compacted sand gave the following results

Normal Pressure (kN/m ²)	Shearing Stress (KN/m ²)	
	Peak Value	Peak Value
45	29	23
90	58	45
135	87	67

Determine the angle of shearing resistance of the sand

- (i) In the compacted state
- (ii) When loose by shearing action

Que 2

- a) Define three main types of soil known
- b) Briefly distinguish between the following
 - (i) Residual soil
 - (ii) Transported soil
- (c) Classification system must satisfy a number of conditions:, define two of them,
- (d) The following data were obtained from a test on a sample of sand using a constant-head permeameter 200 mm diameter with manometer tapping points 300 mm apart: Calculate the permeability *k* of the sample.

<i>Water collected in 1 min (ml)</i>	145	135	163	154
<i>Loss of head between manometers (mm)</i>	83	77	89	86

Que 3

(a) Explain the following terminologies.

- (i) Settlement
- (ii) Initial consolidation
- (iii) State of plastic equilibrium

(b) Briefly describe the experimental procedure for the determination of uniaxial compressive strength of rock

(c) A shear box test was carried out on a loamy soil and yielded the following results

Normal Load (N)	108	202	295	390	484	576
Shear load at failure (N)	172	227	266	323	374	425

(i) Determine the cohesion and the peak angle of cohesion

(ii) If the stress value (σ_n) reduced to 25 kN/m² determine the expected normal shear needed to cause shear failure.

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