



UNIVERSITY MINES AND TECHNOLOGY, TARKWA
FIRST SEMESTER EXAMINATIONS DEC, 2018

COURSE NO: GL 357
COURSE NAME: ROCK MECHANICS
CLASS GLIII

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TIME: 3HRS

SECTION A

Questions 1-15: (NB: Answer Section A on question sheet) Each question carries 2 Marks.

From questions 1-6, state whether the following statement is True or False

Stresses within rock (in pre-mining state) are created through the action of forces which can result from :

- 1 Gravitational loading effect
- 2 Geological action
- 3 Surface phenomenon
- 4 Superincumbent suction
- 5 Tectonic activities
- 6 Blast attenuation

From questions 6-12, state whether the following statement is True or False

- 7 Triaxial stress is the state in which two of the three principal is non- zero
It is believed that permeability is the capacity of rock to conduct liquid or gas
- 8 Mohr envelope is the Mohr circles representing same stress condition at failure for a given material
- 9 Isotropy is a concept of having the same properties in all directions
- 10 A joint is a break of geological origin in the continuity of a body of rock occurring either as a single event or as a set of events.
- 11 A change in volume and original volume of an element of material under stress is regarded as volumetric strain
- 12 Convergence refers to a shortening between a roof and the floor or between walls of underground excavation

Questions 13-15, Provide the needed information in the space

Which critical geotechnical parameters are required for a typical pit design

Que 13.....

Que 14.....

Que 15.....

Question 16-25: Choose the correct answers from the following

Que 16 For jointed rock fully submerged which exhibit no cohesion, the factor of safety is equal to

(a) $1 + (\tan \phi / \tan \delta)$

(b) $1 - (\tan \phi / \tan \delta)$

(c) $\tan\delta/\tan\phi'$

(d) $\tan\phi/\tan\delta$

Que 17 Which of the following represents confining stress

(a) Major principal stress (b) Minor principal stress

(c) Intermediate principal stress (d) Vertical stress

Que 18 Calculate the up lift force exerted perpendicular to a slope face having slope angle of 55° and height of 45m, given that unit weight of the rock material is 19.5 kN/m^3

(a) 16385.

(b) 35153.2

(c) 24102.7

(d) 50124.3

Que 19 Which of the following can be described as plastic rock property

(a) Shear stress/strain behavior (b) Tensile stress/strain behaviour

(c) Compressive stress/strain behavior (d) Nonlinear stress/strain behaviour

Que 20 Given that the core diameter is 60 mm and the and the guage reading at failure is 25 N, determine the point load index

(a) 8.456

(b) 7.538

(c) 9.123

(d) 6.424

Que 21 Inelastic material may exhibit all the properties except

(a) stress/strain curve is linear

(b) typical of intact, hard, brittle rock

(c) when stress is held constant, no additional strain develops

(d) stress/ strain curve is non-linear

Que 22 If the total length of recovered core is 1.46 m is shattered and cannot be accounted for, determine the RQD given that the core run is 3.2 m

(a) 54.4%

(b) 45.6%

(c) 38.3%

(d) 61.7%

Que 23 If the length of sliding block is 20 m long while the width and the breadth are 12 m and 36 m respectively determine the weight if the unit weight is 19.4 kN/m^3

(c) 178.3 tonnes

(b) 268.1 tonnes

(d) 294.8 tonnes

(d) 167.6 tonnes

Que 24 Which of the following is not a rock stabilization method

(a) Increasing shear resistance (b) Increasing normal loading

(b) Increasing lateral loading (c) Increasing cohesion

Que 25 Which of the following has the least influence if the height of a given slope lying below 1000m

(a) Frictional angle

(b) Groundwater

(c) Density

(d) Joint inclination

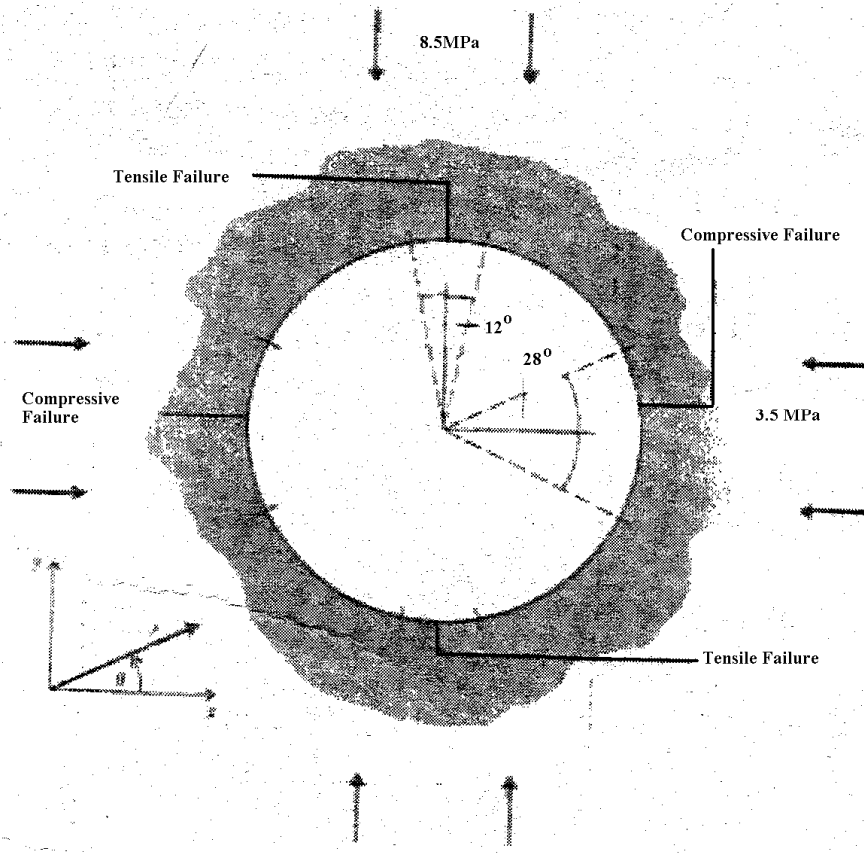
SECTION B

ATTEMPT ANY TWO QUESTIONS FROM THIS SECTION

Que 1:

(25 Marks)

- (a) Briefly explain the following:
- (i) Size effect on sample specimen
 - (ii) Equivalent Dimension
- (b) Explain how a can tensioned mechanically-anchored bolt perform differently from untensioned anchored steel bolt in supporting a possible roof failure.
- (c) A given boundary stress in Fig. 1 is given by the expression below. The uniaxial compressive strength of the rock is 18MPa.
- (i) Indicate whether compressive failure of boundary rock will occur if $K=0.5$
$$\sigma_{\theta\theta} = p[(1 + K) + 2(1 - K) \cos 2\phi]$$
 - (ii) If the tensile strength is zero, determine if tensile failure will occur over the interval satisfying the condition. (NB: $78^\circ < \theta < 102^\circ$)



Que 2**(25 Marks)**

- (a) Carefully define the **three** critical parameters in which pillar strength depend on
- (b) Explain briefly the purpose of support requirement in underground operations.
- (c) It is assumed that a room and pillar design will be employed for a reef –type deposit at a depth of 500 m below surface. The density of the waste rock was 26.7 kN/m^3 . The ore exhibits an unconfined compressive strength of 48.1 MPa. An array of square pillars were to be developed and sized at 20 m by 20 m the distance of separation between successive pillars were centered at 35 m apart. No consideration of pillar height is required.

- Determine
- (i) Pre-mining stress condition
 - (ii) Post –mining stress condition
 - (iii) Ore extraction ratio
 - (iv) Pillar safety factor condition

Que 3**(20 Marks)**

- (a) Briefly describe the experimental procedure for the determination rock porosity
- (b) Briefly discuss three errors which are introduced during laboratory strength testworks.
- (c) Given that the rockmass rating (RMR) of 80 was established for an excavation. Determine the NGI tunneling quality index for that particular tunnel excavation.
- (d) Given that the volumetric joint count is 12, establish the rock quality index (RQD) of the rockmass

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