



FACULTY OF ENGINEERING AND THE ENVIRONMENT
DEPARTMENT OF MINING ENGINEERING
ROCK AND SOIL MECHANICS
EMN 3107
Examination Paper

This examination paper consists of 3 pages

Time Allowed: 3 hours

Total Marks: 100

Examiner's Name: Mr. T Dombo

INSTRUCTIONS

1. **Answer all questions**
2. Use of calculators is permissible

Additional Requirements

Graph paper

Calculator

MARK ALLOCATION

Question 1 to 5	Total 20 marks
Part Questions	As shown in each part question
Total Attainable	100 marks

QUESTION ONE

- (a) Explain in detail why you think the study of rock mechanics is of great benefit to the Zimbabwean Mining industry citing some practical examples. (10)
- (b) Explain five factors that influence pre-mining stress. (10)

QUESTION TWO

- (a) List 10 parameters which are used to describe discontinuities in rock mass. Write the maximum scores of the following as considered in RMR rock classification system: Strength of intact rock, RQD, groundwater conditions and mean spacing of discontinuities (20)

QUESTION Three

- (a) The following strain components were measured at a point in a rock

$$\varepsilon_x = 0.003$$

$$\varepsilon_y = 0.00012$$

$$\gamma_{xy} = 0.0005$$

Determine the principal stresses in the x-y plane given that the modulus of elasticity is 72 GPa and the Poisson's ratio is **0.2**. (10)

- (b) The following stress state exists at a point in rock

$$\sigma_x = 20 \text{ MPa}$$

$$\sigma_y = 40 \text{ MPa}$$

$$\tau_{xy} = 10 \text{ MPa}$$

Make use of the Mohr circle diagram to depict the stress state, indicate the maximum and minimum principal stresses. (6)

- (i) Indicate on the diagram how you would determine the normal and shear stresses on a plane whose normal makes an angle of 15° , measured anti-clockwise with the x-axis. (2)
- (ii) Make a free-hand sketch to illustrate the orientation of the principal stresses relative to the x-y axes. (2)

QUESTION FOUR

In a 1.5 m rock run, the following rock pieces were recovered from the borehole: 50mm, 105mm, 68mm, 128mm, 320mm, 72mm, 161mm, 32mm and 138mm. Find the RQD?

Discuss about the limitations associated with this method of rock classification? Estimate RQD when core recovery is unavailable? (20)

QUESTION FIVE

- a) Define and write a few notes on the following physical properties of rocks:
- i. Specific Gravity of Solids, G_s
 - ii. Unit Weight, γ
 - iii. Porosity, n
 - iv. Water content
 - v. Void ratio, e
 - vi. Permeability **(10)**
- b) Elaborate the relationship between porosity and void ratio. **(5)**
- c) Discuss the importance of porosity as a physical property in relation to mining. **(5)**

END OF EXAMINATION