



FACULTY OF ENGINEERING AND THE ENVIRONMENT

DEPARTMENT OF MINING ENGINEERING

MINING LABORATORIES

EMI 3103

Final Examination Paper

January 2020

This examination paper consists of 3 pages

Time Allowed: 3 hours

Total Marks: 100

Examiner's Name: Mr D. Chawira

INSTRUCTIONS

1. This paper contains One section with Five questions
2. Answer Question One (25 marks) and any other **Three** questions (25 marks each)
3. Where a question contains subdivisions, the mark value of each subdivision is shown in brackets.
4. Start each question on a new page

Additional Requirements

Non-Programmable Calculator

MARK ALLOCATION

Question 1 to 5	25Marks
Part Questions	As shown in each part question
Total Attainable	100

Question 1 (25 marks)

The following are properties and qualities that most samples do possess. Briefly explain the meanings of each of the following using specific examples of known material:

1. Strength
2. Hardness
3. Toughness
4. Elasticity
5. Ductility

[25]

Question 2 (25 marks)

a) On a typical stress-strain graph sketch and explain:

1. linear elasticity
2. the uniaxial compressive strength
3. the uncontrolled brittle failure
4. the ductile behaviour portions of the curve
5. Rapture strength

[12]

b) A UCS test is conducted on a rock sample with a diameter of 54mm. The force that is exerted at failure of the sample is 450kN. Calculate the sample's UCS. [5]

c) A rock sample consisting of a brittle material was placed in a stiff testing machine press to conduct a UCM (uniaxial compressive with modulus) test. In the post-failure part of the test, the sample was unloaded and loaded again at two occasions. The following information is given:

Original sample diameter	42mm	Sample diameter just prior to yielding	44.2mm
Original sample height	90mm	Sample height just prior to yielding	87.5mm
Applied load	155kN		

Calculate Young's Modulus and Poisson ratio of the sample.

[8]

Question 3 (25 marks)

(a) The determination of the Young's modulus is not quite simple due to several factors. What five factors affect the ease of determination of the Young's Modulus [5]

(b) Tensional stresses are a major cause in landslides in open pit mines hence the need to know the respective tensional strength of the in-situ rock prior pit design. Explain with the aid of diagrams how a rock engineer can determine the tensile strength of a rock specimen in a laboratory. [15]

c) With the aid of diagrams, explain bulk modulus and shear modulus in rock mechanics. [5]

Question 4 (25marks)

a) In Environmental Engineering, the use of one fan has been under weighed by the use of more fans in a system. Explain five advantages of using multiple fans in a system over the use of one fan. [10]

b) Explain with the aid of diagrams, the characteristic curves for fans in series and fans in parallel. [10]

c) Noise is regarded as a 'nuisance' on a mine. Briefly describe how noise can be measured at a working face in an underground mining operation. [5]

Question 5 (25 marks)

a) Respiratory related diseases are a common disease found in retired mine workers due to poor safety and health measures during mining operations. Describe a technique that can be used in dust monitoring at a mining setup? [12]

b) Fan efficiency is important as it determines the cost of power necessary to operate the fan. Determine the fan efficiency given:

- fan providing $250m^3/s$; a pressure of 2000Pa ; an electrical power of 667kW [5]

c) State the rules that govern the performance of a fan operating alone in a ventilation system. [8]