



**FACULTY OF ENGINEERING AND THE ENVIRONMENT**

**DEPARTMENT OF MINING ENGINEERING**

**FUNDAMENTALS OF GEOLOGY**

**EMN 2106**

**Final Examination Paper**

**September 2023**

This examination paper consists of 4 pages

**Time Allowed: 3 hours**

**Total Marks: 100**

**Examiner's Name: Mr N Ndlovu**

**INSTRUCTIONS**

1. The examination consists of SIX questions , Answer **ANY FOUR QUESTIONS**
2. Each question carries 25 marks.
3. Answer each question on a new page and write as eligible as possible

**Additional Requirements**

NONE

**MARK ALLOCATION**

|                         |                                       |
|-------------------------|---------------------------------------|
| <b>Question 1 to 6</b>  | <b>25 Marks</b>                       |
| <b>Part Questions</b>   | <b>As shown in each part question</b> |
| <b>Total Attainable</b> | <b>100</b>                            |

**Question 1: Igneous rocks {25 marks}**

- a. Magma is hot molten material found in within the earth’s interior from the melting of the upper mantle and lower crust. Explain the processes of magma formation, incorporating the processes that cause the asthenosphere to melt. [9]
- b. Catalogue and elucidate the components of magma. [6]
- c. With the aid of explicit examples, differentiate between intrusive (plutonic) and extrusive (volcanic) igneous rocks. [4]
- d. Draw and fill in the table below. [6]

| <b>Igneous texture</b> | <b>Example of rock</b> |
|------------------------|------------------------|
| Aphanitic              |                        |
| Phaneritic             |                        |
| Pyroclastic            |                        |
| Vesicular              |                        |
| Glassy                 |                        |
| Porphyritic            |                        |

**Question 2: Metamorphic rocks and Plate Tectonics {25 marks}**

- a. There are three major types of metamorphic textures. Create a table that links these metamorphic textures to the rocks that exhibit each texture. [6]
- b. The Theory of Continental drift explains the idea that the continents were once attached. Using appropriate examples, explain the evidence of continental drift. [5]
- c. Foliation is a fundamental and prominent textural feature of regional metamorphosed rocks. Define foliation, tell how it is formed and identify rocks that exhibit foliation? [6]

- d. What are the different types of plate boundaries and what geological features do they create? Use diagrams where possible. [6]
- e. Briefly describe a metamorphic aureole. [2]

**Question 3: Earth's Internal Structure {25 marks}**

- a. Seismic waves are waves of energy that travel through the Earth's layers and are a result of earthquakes, volcanic eruptions, magma movement, large landslides and large man-made explosions that give out low-frequency acoustic energy. Explain the seismic waves and how they propagate through the Earth's layers. [6]
- b. With the aid of a well annotated diagram, describe the Earth's internal structure. [6]
- c. Compare the continental and oceanic crust in terms of the average density, thickness and rock type. [6]
- d. The core is divided into the inner and outer core. If the inner core is solid, explain why the outer core molten. [2]
- e. The study of geology and processes that shape the Earth are an essential component for a mining engineer. Give reasons. [5]

**Question 4: Sedimentary rocks {25 marks}**

- a. With the aid of a diagram(s), illustrate sediment transportation system, with the processes that occur as sediments are moved in a fluvial system. [10]
- b. Sediments undergo lithification as they get buried. Explain lithification and the processes that contribute to lithification. [4]
- c. Write short notes on the formation of coal. Include the different forms of coal and how they evolve. [6]

- d. List five continental sedimentary depositional environments and the associated rock types. [5]

**Question 5: Mass wasting, weathering, and denudation {25 marks}**

- a. State and explain the factors that affect weathering. [6]
- b. Concisely describe mass wasting and explain any three varieties of mass wasting processes. [6]
- c. List four mechanisms responsible for triggering mass wasting processes. [4]
- d. Define denudation and differentiate between exogenous and endogenous processes that affect denudation. [4]
- e. State the five processes of chemical weathering. [5]

**Question 6: Hydrogeology, erosion and soil formation {25 marks}**

- a. Briefly describe the three sources of groundwater. [6]
- b. Define, with the aid of examples, the following terms used in hydrogeology. [6]
- i. Aquifer [2]
  - ii. Aquiclude [2]
  - iii. Aquitard [2]
- c. Describe the stages for the formation of a soil profile. [5]
- d. State and explain the factors that affect erosion. [8]

**End of exam**