**FACULTY OF ENGINEERING AND THE ENVIRONMENT**

**DEPARTMENT OF METALLURGICAL ENGINEERING**

**DEPARTMENT OF MINING ENGINEERING**

**GEOLOGY FOR ENGINEERS**

**EMR/EMI 2102**

**Final Examination Paper**

**January 2021**

This examination paper consists of 4 pages

**Time Allowed:** **3 hours**

**Total Marks:** **100**

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

**INSTRUCTIONS**

1. This question paper consists of 6 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**

| | |
|---|---|
| **Question 1 to 6** | **25Marks** |
| **Part Questions** | **As shown in each part question** |
| **Total Attainable** | **100** |

Question 1: **Earth's structure and Plate tectonics {25 marks}**

1.1 Copy and accurately fill the table below. [6]

| Type of crust | Density | Composition(minerals) | Composition(rocks) |
|---|---|---|---|
| Continental crust | | | |
| Oceanic crust | | | |

1.2 Define convection and hence explain mantle convection. [4]

1.3 The study of geology and processes that shape the Earth are an essential component for a mining and metallurgical engineer. Give reasons. [5]

1.4 Why is the oceanic crust recording much younger age than the continental crust? [4]

1.5 List the three plate boundary interactions and explain what landforms form in each? [6]

Question 2: **Igneous and metamorphic petrology {25 marks}**

2.1 With the aid of a clearly labelled diagram, explain the Bowen's reaction series. [7]

2.2 Name and explain the three components of a magma? [3]

2.3 Catalogue any 6 textures of igneous rocks. [3]

2.4 Explain the principal factors that drive metamorphism. [6]

2.5 Define foliation and explain how it forms [4]

2.6 List five rocks in order of increasing metamorphic grade. [2]

Question 3: **Sedimentary Petrology {25 marks}**

3.1 There are three types of sediments that lead to the formation of sedimentary rocks. Copy and fill in the table below. [6]

| Types of sediments | Environment found |
|---|---|
| 1. | |
| 2. | |
| 3. | |

3.2 Briefly describe the transportation process of clastic sediments and the type of sediment movement within a river system. [5]

3.3 After deposition of sediments by the different depositional agents, sediments undergo lithification to become hard rock. Explain the term lithification and the processes that occur during lithification. [3]

3.4 Explain in your own words the difference between arenites and lutites. Also give examples of each type of rock. What is the difference? Give examples of rocks. [4]

3.5 Define dolomization and tell where it takes place. [2]

3.6 Explain the formation of an alluvial fan. [3]

3.7 List four marine depositional environments. [2]

Question 4: **Mass wasting, weathering, and denudation {25 marks}**

4.1 Briefly describe mass wasting and list three types of mass wasting processes. [6]

4.2 List four mechanisms responsible for triggering mass wasting processes. [4]

4.3 Define weathering and list four environmental factors affecting the rate of weathering. [5]

4.4 Explain the process of salt crystallization in the weathering of rocks. Give an example of a salt that usually acts on rocks during this process. [3]

4.5 List the five agents of chemical weathering? [5]

4.6 Explain the term denudation. [2]

Question 5: **Hydrogeology, erosion and soil formation {25 marks}**

5.1 Describe how a soil profile is formed from the parent rock. [3]

5.2 Define erosion? [2]

5.3 Explain how climate affects erosion? [4]

5.4 List the three sources of groundwater? [3]

5.5 Explain porosity and permeability, and tell how the two are connected in terms of aquifer recharge and discharge.
[4]

5.6 With the aid of a clearly labelled diagram, explain the hydrological cycle.
[6]

5.7 Name a rock that can be a good aquifer and list the two purposes of an aquifer.
[3]

Question 6: **Miscellaneous**

6.1 Sketch and explain a clearly labelled diagram showing the lithological cycle.
[8]

6.2 Define a mineral. [4]

6.3 Draw a diagram showing the lithosphere and its components, including the Moho.
[5]

6.4 Differentiate between vadose and phreatic zone.
[4]

6.5 Differentiate between leucocratic and mesocratic minerals, giving examples of minerals that fall in each category.
[4]