BINDURA UNIVERSITY OF SCIENCE EDUCATION

JUN 2025

FACULTY OF SCIENCE AND ENGINEERING

DEPARTMENT: ENGINEERING AND PHYSICS

PROGRAMME BSc HONOURS IN MINING ENGINEERING

COURSE CODE (s) MEG1105 (2) : FUNDAMENTALS OF GEOLOGY AND MINING ENGINEERING

DURATION: 3 HOURS TOTAL MARKS: 75

INSTRUCTIONS TO CANDIDATES

ANSWER ANY THREE (3) QUESTIONS. ALL QUESTIONS CARRY EQUAL MARKS (25).

---

1. You are collaborating with geologists in a mineral exploration project focused on assessing the potential of a newly identified region.

(a) While analyzing thin sections of basaltic and granitic rock samples, you observe a clear sequence of mineral crystallization. Use Bowen's Reaction Series to interpret the cooling history and relative mineral stability of these rocks. Explain how this understanding can guide mineral exploration efforts, particularly in identifying zones that may host economically valuable mineral assemblages. (10)

(b) During core logging, you come across several intrusive igneous rocks that display differences in grain size and crystal structure. Classify these rocks based on their textures (e.g., phaneritic, aphanitic, porphyritic) and explain how these textures reflect the cooling conditions at the time of their formation (e.g., slow cooling at depth vs. rapid cooling near the surface). (15)

---

2. (a) As a recent member of a mining consultancy firm tasked with evaluating and improving both open-pit and underground mining operations, a client has asked for advice on how to **maximize ore recovery** while keeping **costs and risks low**. Prepare a **summary of the main mining methods**, providing a brief explanation of each. Based on different **orebody shapes and orientations,** suggest the most appropriate methods that balance efficiency, safety, and cost. (15)

(b) While on a site visit to an underground mine, you identify **several safety issues.** Draft a concise **inspection report** outlining the potential hazards you observed. Recommend a set of **practical safety measures** to reduce risk and improve workplace safety. (10)

3. As an analyst involved in evaluating sedimentary basins to identify potential reservoir rocks for hydrocarbon or groundwater resources:

(a) You receive a batch of clastic sediment samples recovered from a borehole. Use the Wentworth-Udden grain size scale to classify the sediments and based on the grain sizes, suggest possible depositional environments. (12)

(b) In a thin section of a rock sample, you identify the following composition:

- 60% feldspar
- 10% quartz
- 30% lithic fragments
- 20% clay matrix

Which classification system would you use to name and classify this rock sample? Explain your classification by discussing both framework grain proportions and matrix content, and relate it to its diagenetic history and potential source environment. (13)

---

4. You have joined a holding company whose portfolio includes cement production, gold exploration, coal mining, iron ore mining and copper-nickel tenement acquisitions. There is shortage of raw materials for production. Your job is to complete any two (2) of the following tasks:

(a) Give an account of raw materials used in cement industry, where they can be found in Zimbabwe and what processes are required to get the raw materials to the factory. (12.5)

(b) Give an account of gold deposits of Zimbabwe and their regional setting. (12.5)

(c) Write a technical note on coal fields of Zimbabwe. (12.5)

(d) Explain the general stratigraphy of Zimbabwe and associated mineral deposits. (12.5)

---

5. You are consulting for a research project on different regions of Zimbabwe.

(a) During a field trip, students observe various discrepancies within rock sequences. Help them to discuss different types of unconformities and their recognition in the field. (11)

(b) While studying the rock units, you observe bends or curves in rock layers due to compressional forces. Using neat sketches, explain what these bends are and how they are classified. (14)

END OF PAPER