



FACULTY	Agriculture, Engineering and Natural Sciences		
DEPARTMENT	Geosciences		
SUBJECT	Environmental & Engineering Geology II		
SUBJECT CODE	GLE3821		
PAPER	PAPER 1 – combined theory & practical		
DATE	June/July 2026		
DURATION	180 min (3 hours)	MARKS	100

FIRST OPPORTUNITY EXAMINATION

Examiner: Dr Josefina T Hamutoko & Prof Akaha Tse

Internal Moderator: Dr Shoopala Ugulu

External Moderator: Prof Heike Wanke

This question paper consists of 5 pages (including this one)

Instructions

- Closed book examination
- This question paper consists of two parts: A and B, each part is worth 50 marks.
 - answer all three (3) questions in section A
 - answer any two (2) questions in section B.
- Start each question on a new page.
- Recommendation: read first all subordinate questions before you answer.
- Calculators necessary.

Question 1 [20 Marks]

Lead mining has historically been associated with significant environmental and health impacts, a reality mirrored in the small southern mining town of Rosh Pinah, Namibia. Zinc was first discovered in Rosh Pinah in 1963, with mining operations commencing in 1969. The ore deposit comprises a stratabound stratiform zinc sulfide deposit within the upper volcanoclastic portion of the Precambrian Kapok formation, associated with pyrite gangue and minor copper content.

You are an environmental geologist responsible for the environmental issues in the Kharas region. You are required to design and implement a comprehensive sampling strategy to assess the extent of contamination and determine its potential risks.

- 1.1 Will the pollution at this site be a point or non-point source? [1 Mark]
- 1.2 State three primary sources of contamination in the Rosh Pinah mining area. [3 marks]
- 1.3 What contaminants of concern are associated with the ore body and mining waste in Rosh Pinah? [3 Marks]
- 1.4 What are some of the key questions that will guide your sampling strategy when assessing the spread of this contamination and its potential risks? Name Five. [10 Marks]
- 1.5 Would acid mine drainage (AMD) be expected at Rosh Pinah? Justify your answer. [3 marks]

Question 2 [15 Marks]

2.1 As an environmental specialist, you are asked to evaluate if a proposed site is in an appropriate area for a landfill. Discuss key factors that you will take into consideration in your evaluation. [8 marks]

2.2 Imagine oil/petroleum products are dumped at this disposal site. How will it affect the environment? [3 marks]

2.3 Suggest a remediation strategy if oil/petroleum products are to be dumped at this site. [4 marks]

Question 3 [15 Marks]

You are an EIA expert for a geo-environmental consulting company. An investor has approached you to conduct an EIA because they would like to develop a project in the Keetmanshoop area.

3.1 Discuss what a project is in terms of EIA. [5 Marks]

3.2 Compare the use of in-house and consultant methods for quality control during the EIA process. [10 Marks]

Part B: Engineering Geology

[50 Marks]

ANSWER ANY TWO (2) QUESTIONS

Question 4 [25 marks]

You are a consultant for a civil engineering company. You are tasked to carry out a geotechnical investigation to derive the index properties and mechanical/design parameters of soil underlying a site for the design and construction of civil engineering structures.

4.1 Briefly describe the stages of the investigation you will carry out. [5 marks]

4.2 During the investigation, a borehole drilled penetrated the following thicknesses of soil: topsoil (1 m), clay (3 m), clayey sand (2 m), sand (7 m). SPT N-values at 8 m and 10 m were 6-7-8 and 10-15-20, respectively. The water table was encountered at 3 m. Construct a lithologic log to represent these data [5 marks]

4.3 Suggest with reason/s the type and depth of the foundation you would recommend for a five-storey building on this site, considering the data provided in question 4.2. [5 marks]

4.4 A 3m-wide footing is founded 3 m into the soil. The unit weight is 19.3 kN/m^3 . Triaxial tests gave undrained cohesion is 40 kN/m^2 and the undrained frictional angle is 15° . Terzaghi's bearing capacity factors are: $N_c = 11.00$, $N_\gamma = 1.40$ and $N_q = 4.00$. Calculate the ultimate bearing capacity of the soil and allowable pressure at the foot of the foundation. [5 marks]

4.5 Give an outline of a soil investigation report of the site. [5 marks]

Question 5 [25 marks]

After completing your B.Sc. (Hons) in Geology, you have been invited to an interview for an engineering geologist position at a mine. Prepare for the interview by answering the following questions.

5.1 List and describe five (5) engineering geological problems of mines. [15 marks]

5.2 State how each of the problems you identified in 5.1 may be prevented or mitigated. [10 marks]

Question 6 [25 marks]

6.1 Explain why ground improvement is necessary in a site with poor soil engineering properties for civil engineering structures. [4 marks]

6.2 State four (4) methods of ground improvement. [4 marks]

6.3 Soil samples were obtained from two burrow pits to determine their suitability as backfill materials for pavement in a road construction project. Results of the Proctor compaction test of the soils are shown in the following table.

Soil A

Moisture content	8	12	14	16	19	21
Dry Density (g/cm^3)	1.7	1.8	1.9	1.8	1.7	1.6

Soil B

Moisture content	10	12	14	16	18	20
Dry Density (g/cm^3)	1.4	1.6	1.8	1.9	1.8	1.6

- Draw the compaction curves of the two soils on the graph sheet provided. [10 marks]
- Deduce the maximum dry density and optimum moisture content of each soil. [4 marks]
- State which soil will be preferable as a pavement material. Give a reason for your answer. [3 marks]

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END OF EXAM