



**ZIMBABWE**

**MINISTRY OF HIGHER AND TERTIARY EDUCATION,  
INNOVATION, SCIENCE AND TECHNOLOGY  
DEVELOPMENT**

**HIGHER EDUCATION EXAMINATIONS COUNCIL  
(HEXCO)**

**HIGHER NATIONAL DIPLOMA**

**IN**

**CIVIL ENGINEERING**

**SUBJECT: Geotechnology**

**PAPER NO: 778/17/S01**

**DURATION: 3 Hours**

**MARCH/APRIL 2024 EXAMINATION**

**REQUIREMENTS**

**INSTRUCTIONS TO CANDIDATE**

**Answer all questions.**

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*This paper consists of 3 printed pages.*

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QUESTION 1

- a) Define the following:
- i) Mass specific gravity
  - ii) Specific gravity of solids
  - iii) Saturated unit weight of solids
  - iv) Submerged (Buoyant) unit weight
  - v) Porosity
  - vi) Air content
  - vii) Void ratio
  - viii) Allowable bearing capacity
  - ix) Dead body
  - x) Seismic forces (10 marks)
- b) What should a good exploration report comprise of? (15 marks)

QUESTION 2

- a) Briefly discuss the uses of geotextiles in Civil engineering. (8 marks)
- b) A vertical wall, 9m high supports cohesive soil which has a surface that is level with the top of the wall.  
Cohesion is  $30\text{KN}/\text{m}^2$ , the angle of shearing resistance is  $10^\circ$  and the density of the soil is  $1900\text{kg}/\text{m}^3$ .
- i) Determine the active thrust on the wall per metre, assuming that the soil is well drained and neglecting frictional and cohesive forces on the back of the wall. (12 marks)
  - ii) Determine the soil pressure if the soil is water logged, with a saturated density of  $200\text{ kg}/\text{m}^3$ . (5 marks)

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QUESTION 3

- a) For a given soil the cohesion is  $48\text{KN/m}^2$ , the unit weight is  $18.9\text{KN/m}^3$  and the coefficients are:

$$N_c = 8, N_q = 3, N_{\alpha} = 2$$

- i) Calculate the net bearing Capacity for a strip footing of width 2m at a depth of 1m. (6 marks)
- ii) Considering shear failure only, Calculate the safe total load on a footing 6m long by 2m wide, using a load factor of 2.5 (6 marks)
- b) Discuss the effects of soil stabilisation in building and road construction projects. (14 marks)

QUESTION 4

- a) i) What causes stress in a soil. (2 marks)
- ii) Describe the term settlement as it is applied to foundations. (3 marks)
- iii) Outline factors that constitute or contribute towards settlement. (4 marks)
- b) i) How does compaction affect bearing soil characteristics. (6 marks)
- ii) List different types of equipment used to carry out compaction in the field. (10 marks)

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