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## TECHNICAL UNIVERSITY OF MOMBASA

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SCHOOL OF ENGINEERING AND TECHNOLOGY  
DEPARTMENT OF BUILDING & CIVIL ENGINEERING  
UNIVERSITY EXAMINATION FOR:

BACHELOR OF **SCIENCE** IN CIVIL ENGINEERING  
**ECV 4515 : GEOTECHNICAL ENGINEERING**

SPECIAL/SUPPLEMENTARY EXAMINATION  
SERIES: MARCH 2025

TIME: 2 HOURS

### Instructions to Candidates

You should have the following for this examination

*-Answer Booklet, examination pass and student ID*

This paper consists of **five** questions.

Attempt question ONE (Compulsory) and any other TWO questions.

**Do not write on the question paper.**

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### QUESTION ONE (COMPULSORY)

(30 Marks)

- a) Discuss two types of embankment dams. **(8marks)**
- b) A soil sample, in its natural condition, has a mass of 2.29 kg and a volume of  $1.15 \times 10^{-3} \text{ m}^3$ . After oven drying, the mass of the sample is 2.035 kg. Specific gravity (GS) is 2.68. Determine the following;
- i) Bulk density
  - ii) Water content
  - iii) Void ratio
  - iv) Porosity
  - v) Degree of saturation. **(7marks)**
- c) i) Outline the objectives of in-situ field testing. **(2marks)**  
ii) Using illustrations, discuss soil phases. **(5marks)**
- d) Discuss “Frost Action” in soils and how it can be mitigated. **(8marks)**

**ANSWER ANY TWO QUESTIONS FROM THIS SECTION**

**QUESTION TWO**

**(20 Marks)**

- a) Using illustrations, explain the following geotechnical structural terms;
- i) Bedding planes **(2marks)**
  - ii) Faults **(2marks)**
  - iii) Folds **(2marks)**
  - iv) Joints **(2marks)**
  - v) Dykes **(2marks)**
- b) A sample of saturated clay has a mass of 1.526 kg. and a dry mass of 1.053kg. The specific gravity of the solid particles is 2.7. For the sample, determine;
- i) Water content
  - ii) Void ratio
  - iii) Porosity
  - iv) Total density. **(8marks)**
- c) Give examples of cohesion less soils. **(2marks)**

**QUESTION THREE (20 Marks)**

- a) Discuss residual soils. **(10marks)**
- b) Outline the factors affecting the choice of a dam site. **(10marks)**

**QUESTION FOUR**

**(20 Marks)**

- a) A moist sample of soil has a volume of  $464\text{cm}^3$  in its natural state and weighs 793g. The dry weight is 735g and has a specific gravity of 2.68. For the sample, determine;
- i) Void ratio
  - ii) Porosity
  - iii) Water content
  - iv) Degree of saturation. **(6marks)**
- b) Discuss **four (4)** types of Geo-synthetics. **(10marks)**
- c) Outline the main uses of a dam. **(4marks)**

**QUESTION FIVE**

**(20 Marks)**

- a) Outline the objectives of ground investigation. **(6marks)**
- b) Outline the factors affecting tunnel construction standup time. **(8marks)**
- c) Discuss the purposes of Tunneling. **(6marks)**