



TECHNICAL UNIVERSITY OF MOMBASA

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

BACHELOR OF SCIENCE IN CIVIL ENGINEERING
ECV 4515 : GEOTECHNICAL ENGINEERING

END OF SEMESTER EXAMINATION
SERIES: JANUARY 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.

QUESTION ONE (COMPULSORY)

(30 Marks)

- a) A soil sample, in its natural condition, has a mass of 2.29 kg and a volume of 1.15^{-3} 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)**
- b) Explain the uses of Tunnels. **(6marks)**
- c) i) Outline the objectives of in-situ field testing. **(3marks)**
ii) Using illustrations, discuss soil phases. **(6marks)**
- 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) Briefly describe the formation of tropical residual soils. **(8marks)**
- b) Discuss the factors affecting the choice of a dam site. **(10marks)**
- c) Define residual soils. **(2marks)**

QUESTION FOUR

(20 Marks)

- a) Discuss the following in-situ field tests. i. Standard Penetration Test ii. Vane shear test. **(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) Discuss the factors affecting tunnel construction standup time. **(8marks)**
- c) Discuss effects of the following; i. Rock fracture ii) Size effects ii) Ground water **(6marks)**