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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: APRIL 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) Discuss the following in-situ field tests. i. Standard Penetration Test ii. Vane shear test.

(8marks)

b) A soil sample, in its natural condition, has a mass of 2.30 kg and a volume of $1.15X10^{-3}$ m^3. After oven drying, the mass of the sample is 2.040 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. **(6marks)**

c) An oven-dried sample having mass of 195g was put inside a pycnometer which was then completely filled with distilled water. The mass of pycnometer with soil and water was found to be 1584g. The mass of pycnometer filled with water alone was 1465g. Calculate the Specific Gravity of soil solids **(4marks)**

d) Using illustrations, discuss soil phases. **(6marks)**

e) Outline the main uses of a dam. **(6marks)**

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)

b) 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 **four (4)** types of Geo-synthetics. **(10marks)**

b) Discuss "Frost Action" in soils and how it can be mitigated. **(10marks)**

QUESTION FIVE **(20 Marks)**

a) Outline the objectives of ground investigation. **(6marks)**
b) Discuss the factors affecting tunnel construction stand-up time. **(8marks)**
c) Discuss effects of the following; i. Rock fracture ii) Size effects ii) Ground water **(6marks)**