



MACHAKOS UNIVERSITY

University Examinations for 2021/2022

SCHOOL OF ENGINEERING AND TECHNOLOGY

DEPARTMENT OF BUILDING & CIVIL ENGINEERING

FIFTH YEAR SECOND SEMESTER EXAMINATION FOR

BACHELOR OF SCIENCE (CIVIL ENGINEERING)

ECV 507: GEOTECHNICAL ENGINEERING

DATE: 10/12/2021

TIME: 2.00-4.00 PM

INSTRUCTIONS

*This paper comprises of FIVE questions. Answer **THREE** questions*

*Question one is **compulsory** and carry 30 marks*

*Answer any other **TWO** questions*

QUESTION ONE (COMPULSORY) (30 MARKS)

- a) State FIVE types of areas covered in the field of Geotechnical Engineering (10 marks)
- b) Define the Following Terms as applied in Geotechnical Engineering
 - i) Dam
 - ii) In-Situ Field Tests
 - iii) Pile
 - iv) Geosynthetics
 - v) Tunnel (10 marks)
- c) Describe FOUR factors affecting response of rocks to imposed loads (10 marks)

QUESTION TWO (20 MARKS)

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 being completely dried in an oven, the mass of the sample is 2.035 kg. The value of specific gravity (G_s) is 2.68. Determine the following:

- a) Bulk Density
- b) Unit Weight
- c) Water Content
- d) Void Ratio
- e) Porosity

- f) Degree of Saturation
- g) Air content

QUESTION THREE (20 MARKS)

- a) Define the Term ROCK (4 marks)
- b) Describe briefly the Types of Rock Discontinuities (8 marks)
- c) Discuss in details In-Situ Field Testing Process (8 marks)

QUESTION FOUR (20 MARKS)

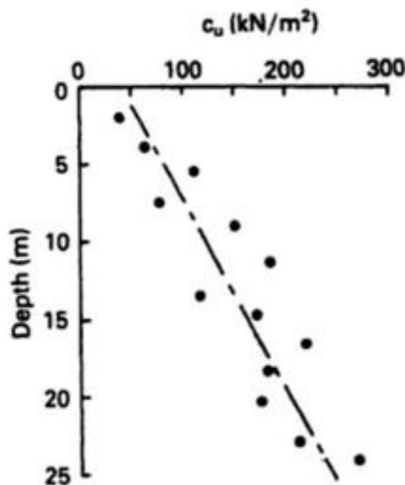
Discuss in details the Phases involved in Site Investigation.

QUESTION FIVE (20 MARKS)

- a) An under-reamed bored pile is to be installed in a stiff clay. The diameter of the shaft pile and under-reamed base are 1.05 m and 3.00 m respectively. The pile is to extend from a depth of 4 m to a depth of 22 m in the clay, the top of the under-ream being at a depth of 20 m. The relationship between undrained shear strength and depth is as shown here below. The adhesion coefficient α is 0.4.

Determine the allowable load on the pile to ensure:

- i. An overall load factor of 2
- ii. A load factor of 3 under the base when shaft resistance is fully mobilized.



- b) State FIVE common causes of dam leakage