MACHAKOS UNIVERSITY

University examinations 2022/2023

SCHOOL OF ENGINEERING AND TECHNOLOGY

DEPARTMENT OF BUILDING AND CIVIL ENGINEERING

FIFTH YEAR SPECIAL/SUPPLEMENTARY EXAMINATION FOR BACHELOR IN CIVIL ENGINEERING

ECV 507: GEOTECHNICAL ENGINEERING

Date 9/3/2023 time 8:30 – 10:00 AM

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 (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) A soil sample in its natural condition has a mass of 2.29 kg and a volume of 1.15 x 10-3 m3. After being completely dried in an oven, the mass of the sample is 2.035 kg. The value of specific gravity ( ) is 2.68. Determine the following:

i. Bulk Density

ii. Unit Weight

iii. Water Content

iv. Void Ratio

v. Porosity

vi. Degree of Saturation

vii. Air content (20 Marks)

QUESTION THREE (20 Marks)

a) Define the Term ROCK (4 Marks)

b) Describe briefly the Types of Rock Discontinuities (8 Mark

c) Discuss in details In-Situ Field Testing Process (8 Marks)

QUESTION FOUR (20 Marks)

a) Discuss in details the Phases involved in Site Investigation (20 Marks)

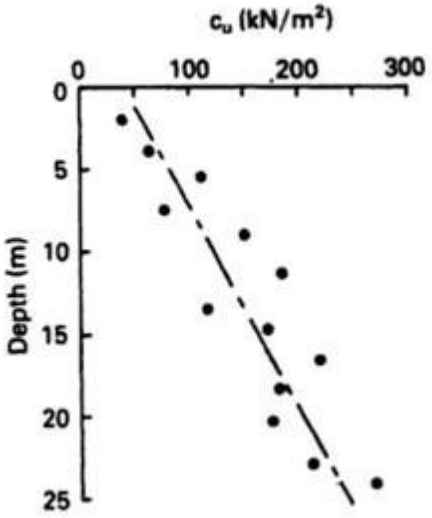
QUESTION FIVE (20 Marks)

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 shat resistance is fully mobilized.



(10 Marks)

b) State FIVE common causes of dam leakage (10 Marks)