



TECHNICAL UNIVERSITY OF MOMBASA

FACULTY OF ENGINEERING AND TECHNOLOGY

DEPARTMENT OF BUILDING AND CIVIL ENGINEERING

UNIVERSITY EXAMINATION FOR:

BSC IN CIVIL ENGINEERING

ECE 2508 : GEOTECHNICAL ENGINEERING

END OF SEMESTER EXAMINATION

SERIES: APRIL 2016

TIME: 2 HOURS

DATE: 9 May 2016

Instructions to Candidates

You should have the following for this examination

-Answer Booklet, Drawing Instruments, Scientific calculator, examination pass and student ID

This paper consists of five questions.

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

Question One (Compulsory) (30marks)

- a) Define Geotechnical engineering and highlight its importance in Civil Engineering. **(4marks)**
- b) Define "Frost Action" in soils and how it can be mitigated. **(8marks)**
- c) i) Outline the main objectives of site investigation. **(4marks)**
ii) Explain the **THREE** phases of site investigation prior to the design of major works. **(6marks)**
- d) Discuss eight important soil properties used by geotechnical engineers to analyze site conditions for design purposes. **(8marks)**

Question Two (20marks)

- a) Briefly discuss **Five (5)** factors affecting the selection of a dam site. **(10marks)**

- b) A soil sample in its natural state has a mass of 2.29kg and a volume of 1.15×10^{-3} . Under an oven dried state, the dry mass of the sample is 2.035kg. The specific gravity of the solids is 2.68. determine the following:-
- i) Total density (2mark)
 - ii) Water content (2mark)
 - iii) Porosity (2mark)
 - iv) Degree of saturation (2mark)
 - v) Void ratio. (2mark)

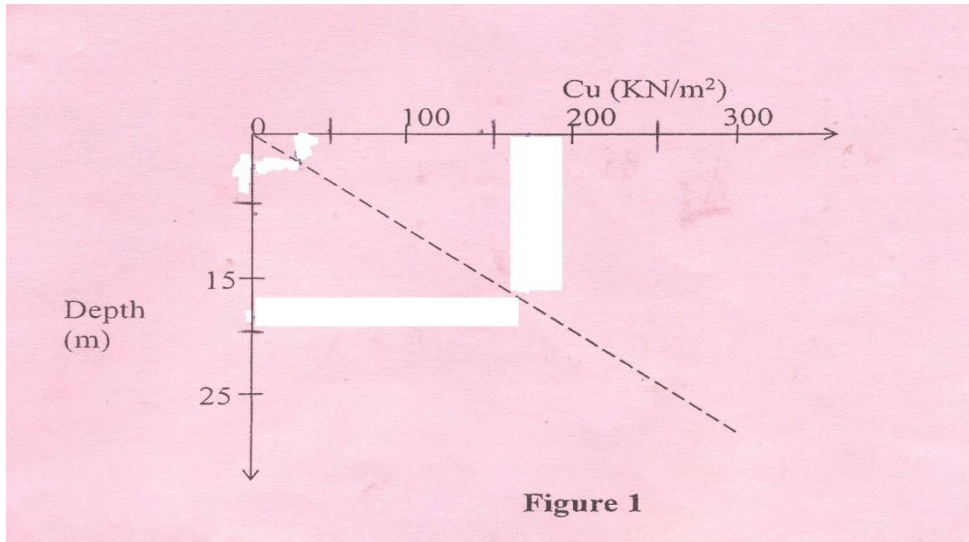
Question Three

- a) Outline three field tests commonly used in subsurface soil investigation for foundations. (6marks)
- b) Explain the Electrical Resistivity sounding method for ground investigation. (10marks)
- c) Briefly describe a dam. (4marks)

Question Four

(20marks)

- a) Describe three types of Piles according to their materials of composition. (5marks)
- b) Explain **seven** (7) circumstances where piles can be used. (7marks)
- c) An under-reamed bored pile is to be installed in stiff clay. The diameters of the pile shaft and under-reamer base are 1.05m and 3.0m respectively. The pile is to extend from a depth of 4m to a depth of 22m in the clay, the top of the under-reamer being at a depth of 20m. The relationship between undrained shear strength and the depth is as shown in Fig. 1. The adhesion coefficient α is 0.4.



Determine the allowable load on the pile to ensure;

- a) An overall load factor of 2
- b) A load factor of 3 under the base when shaft resistance is fully mobilized. **(8marks)**

Question Five

(20marks)

- a) What are Geosynthetics? **(3marks)**
- b) Briefly discuss **Three (3)** types of geosynthetics. **(6marks)**
- c) Define a Tunnel. **(2marks)**
- d) What are the factors that determine the stand-up time? **(3marks)**
- e) Briefly discuss the following types of earth dams; i) Diaphragm dam, ii) Homogeneous dam **(6marks)**