# THE MOMBASA POLYTECHNIC UNIVERSITY COLLEGE

## (A Constituent College of JKUAT)

(A Centre of Excellence)

# Faculty of Engineering & Technology

DEPARTMENT OF BUILDING & CIVIL ENGINEERING

**UNIVERSITY EXAMINATION FOR:**
BACHELOR OF SCIENCE IN CIVIL ENGINEERING

ECE 2508: GEOTECHNICAL ENGINEERING

**SPECIAL/SUPPLEMENTARY EXAMINATION**
**SERIES:** FEBRUARY 2013
**TIME:** 2 HOURS

**Instructions to Candidates:**
You should have the following for this examination
- *Answer Booklet*

This paper consists of **FIVE** questions.
Answer question **ONE (COMPULSORY)** and any other **TWO** questions
Maximum marks for each part of a question are as shown
This paper consists of **THREE** printed pages

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**Question One (Compulsory)**

**a)** Define geotechnical engineering and outline its importance in civil engineering. **(4 marks)**

**b)** Explain the meaning of the following structural term in geotechnical engineering.
(i) Folds
(ii) Faults
(iii) Joints
(iv) Dykes
(v) Bedding
**(vi)** Planes **(10 marks)**

**c)** State the objectives of site investigation, explaining the three phases of site investigation prior to the design of major works. **(8 marks)**

**Question Two**

**a)** There are two categories of site investigation reports in geotechnical engineering. Briefly describe them. **(4 marks)**

**b)** Outline the **THREE** field tests commonly used in subsurface soil investigation for foundation. **(6 marks)**

**c)** Briefly describe the principal objectives of in-situ field testing. **(6 marks)**

**d)** Explain 'frost action' in soils and how the problem can be solved. **(4 marks)**

**Question Three**

**a)** What are geosynthetics? **(4 marks)**

**b)** Describe **FOUR** functions of geotextiles when they are incorporated into a soil structure. **(8 marks)**

**c)** Write short notes of the following:

(i) Geogrids
(ii) Geonets
(iii) Geomembranes
(iv) Geosynthetic clay liners **(8 marks)**

**Question Four**

**a)** Give a brief description of a dam. **(4 marks)**

**b)** Briefly discuss the main functions of geosynthetics. **(10 marks)**

**c)** Explain how ground conditions and environmental aspects can influence choice of tunneling methods. **(6 marks)**

**Question Five**

**a)** What are 'piles'? Give the three types of piles according to composition. **(6 marks)**

**b)** Outline the major uses of piles. **(6 marks)**

**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 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 below. The adhesion coefficient $\alpha$ is 0.4.

Figure 1

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. **(8 marks)**