THE MOMBASA POLYTECHNIC UNIVERSITY COLLEGE

(A Constituent College of JKUAT)
Faculty of Engineering and Technology

DEPARTMENT OF BUILDING AND CIVIL ENGINEERING

UNIVERSITY EXAMINATION FOR BACHELOR OF SCIENCE IN BUILDING & CIVIL ENGINEERING

ECE 2311: SOIL MECHANICS II

END OF SEMESTER EXAMINATION

SERIES: DECEMBER 2011

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)** from **SECTION A** and any other **TWO** questions from **SECTION B**
Maximum marks for each part of a question are clearly shown
This paper consists of **THREE** printed pages

SECTION A (COMPULSORY)

Question 1 (30 marks)

a) Identify and outline **FOUR** objectives of site investigation (10 marks)

b) With the aid of relevant diagrams, describe FOUR methods used in site exploration (10 marks)

c) In a vane test a torque of 46Nm is required to cause failure of the vane in a clay soil. The vane is 150mm long and has a diameter of 60mm

Calculate the apparent shear strength of the soil from this test. When the vane of 200mm length and a diameter of 90mm is used in the same soil, the torque at failure was 138Nm. Calculate the ratio of shear strength of the clay in a vertical dimension to that in a horizontal direction (10 marks)

SECTION B (Attempt any TWO questions)

Question 2 (20 marks)

a) Define shear strength as used in soils (4 marks)

b) A shear box test carried out on sandy clay gave the following results

Vertical load (Kg)	**Division of proving ring dial gauge (One division to 1 μm,)**
36.8	17
73.5	26
110.2	35
146.9	44

If the shear box is 60mm square and the proving ring constant is 20N/ μm, Determine the apparent cohesion and the angle of internal friction for this soil (10 marks)

c) Explain the following terms as applied to saturated soils
   (i) Total pressure
   (ii) Effective pressure
   (iii) Pore-water pressure (6 marks)

Question 3 (20 marks)

a) A temporary cutting of homogenous clay has a density of 1900kg/m^3, cohesion 55KN/m^2 and angle of resistance zero. (10 marks)

   Find the factor of safety for a slip circle of radius 17m, area of the circle 184m2, lever arm 4.6m and angle 89 degrees. Allow for tension crack filled with water (10 marks)

b) Explain the following terms as used in soil mechanics
   (i) Angle of obliquity
   (ii) Principal plane
   (iii) Cohesion
   (iv) Principal stress (10 marks)

Question 4 (20 marks)

a) Coulumb's law in its simplest form may be stated as:

$$\tau = c + \sigma \tan\varphi$$

   State the meaning of each term. (8 marks)

b) With the aid of diagrams, describe the following soil shear tests

(i) Triaxial test
(ii) Unconfined compression test (12 marks)

Question 5 (20 marks)

a) Discuss the various methods of soil stabilization (10 marks)

b) A series of undrained triaxial tests on samples of saturated soil gave the following results:

Lateral pressure (kN/m^2)	100	200	300
Pore water pressure (kN/m^2)	20	70	136
Principal stress difference at failure (KN/m^2)	290	400	534

Find the values of the parameters c and φ:

(i) With respect to total stress
(ii) With respect to effective stress (10 marks)