# TECHNICAL UNIVERSITY OF MOMBASA

# Faculty of Engineering & Technology

### DEPARTMENT OF BUILDING & CIVIL ENGINEERING

### DIPLOMA IN BUILDING & CIVIL ENGINEERING (DBCE 12M)

### EBC 2206: SOIL MECHANICS I

### SPECIAL/SUPPLEMENTARY EXAMINATION
### SERIES:  OCTOBER 2013
### TIME ALLOWED:  2 HOURS

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

This paper consists of **FIVE** questions.
Answer any **THREE** questions
Maximum marks for each part of a question are as shown
This paper consists of **THREE** printed pages

**Question One**

a) Explain **THREE** factors that influence permeability. **(6 marks)**

b) Briefly describe the pumping tst for unconfined aquifer **(7 marks)**

c) A variable head method was used to test permeability on a soil sample of length 350mm. The water level in a 30mm diameter stand pipe fell from 1600mm to 1000mm after 60 seconds. Determine the coefficient of permeability of the soil if diameter of the sample was 90mm. **(7 marks)**

**Question Two**

a) Outline the procedure for carrying out liquid limit using cone penetrometer apparatus

**(10 marks)**

b) Determine the saturation capacity of a soil, given:
   **(i)** Bulk density = 1.96g/cc
   **(ii)** Specific gravity = 2.75
   **(iii)** Moisture content = 16% **(6 marks)**

c) Explain the following terms:
   **(i)** Fire-grained soils
   **(ii)** Coarse-grained soils **(4 marks)**

**Question Three**

a) Define the following terms as applied in soil mechanics:
   **(i)** Degree of saturation
   **(ii)** Bulk unit weight
   **(iii)** Porosity

b) A sample of soil has a mass of 30.6kg when weighed and its volume was found to be $0.0183m^3$. When dried in an oven the mass was reduced to 27.2kg. If the specific gravity of the soil was 2.65, determine the following:
   **(i)** Bulk density
   **(ii)** Dry density
   **(iii)** Percentage moisture content
   **(iv)** Percentage air voids
   **(v)** Void ratio
   **(vi)** Porosity
   **(vii)** Critical hydraulic gradient **(15 ½ marks)**

**Question Four**

a) Outline FOUR main areas where soil mechanics is of great importance. **(8 marks)**

b) Derive the expression of dry density in terms of density of water, particles specific gravity and void ratio. **(6 marks)**

**c)** (i) Define the term "moisture content" as applied to soils.

(ii)     In a moisture content test for a certain soil, the following data was recorded as shown in table 1.

| Mass of Empty Tin (g) | 16.24 | 16.18 |
|---|---|---|
| Tin + Wet Soil (g) | 29.30 | 27.11 |
| Tin + Dry soil (g) | 26.96 | 25.06 |

Calculate the moisture content of the soil                                                          **(6 marks)**

**Question Five**

**a)** (i) Explain the term "Critical hydraulic gradient"
(ii) Distinguish flow lines from equipotential lines                                   **(5 marks)**

b) The shear strength of soil was tested under drained conditions using a direct shear box.  The results obtained are shown in table 2

| TEST NUMBER | 1 | 2 | 3 | 4 |
|---|---|---|---|---|
| NORMAL STRESS (KM/m$^2$) | 90 | 170 | 305 | 350 |
| SHEAR STRESS AT FAILURE (KN/m$^2$) | 60 | 90 | 120 | 150 |

**(i)**     Use the results to draw the Coulomb diagram on a graph paper
**(ii)**     Determine shear strength parameters for the soil tested.                  **(6 marks)**

**c)** Outline THREE factors that affect compaction                                      **(9 marks)**