# TECHNICAL UNIVERSITY OF MOMBASA

# Faculty of Engineering & Technology

DEPARTMENT OF BUILDING & CIVIL ENGINEERING

**DIPLOMA IN BUILDING & CIVIL ENGINEERING (DBCE 13M)**

EBC 2205: SOIL MECHANICS I

**END OF SEMESTER EXAMINATION**
SERIES: APRIL 2014
**TIME ALLOWED:** 2 HOURS

**Instructions to Candidates:**

You should have the following for this examination

- *Answer booklet*
- *Calculator*

This paper consists of **FIVE** questions. Answer any **THREE** questions of the **FIVE** questions

All questions carry equal marks
Maximum marks for each part of a question are as shown
This paper consists of **THREE** printed pages

**Question One**

a) (i) Outline the importance of soil mechanics in regard to construction of buildings:
(ii) State FIVE main factors upon which soil characteristics depend. **(8 marks)**

b) Define:
(i) Porosity
(ii) Void ratio
(iii) Degree of saturation **(6 marks)**

c) A moist soil sample has a volume of 464cm$^3$ in natural state and weighs 793g. The dry weight is 73g and has a specific gravity of 2.68. Determine:
(i) Void ratio
(ii) Porosity
(iii) Water content
(iv) Degree of saturation **(6 marks)**

**Question Two**

**a)** Outline the procedure for constant head permeability test. **(10 marks)**

**b)** A permeameter of diameter 82.5mm contains a column of fine sand 450m long. When water flows through under constant head at the rate of 180m/min, the loss of head between two points 250mm apart is 300mm. Calculate the coefficient of permeability in mm/s **(5 marks)**

**c)** A sample of soil weighing 40.8kg had a volume of 0.025m3. When oven dried, its weight was reduced to 38.4kg. The specific gravity of the solids was found to be 2.72. Determine the following:
**(i)** Bulk density
**(ii)** Dry density
**(iii)** Saturated density
**(iv)** Percentage air voids
**(v)** Void ratio **(5 marks)**

**Question Three**

**a)** Define the following terms:
**(i)** Liquid limit
**(ii)** Plastic limit
**(iii)** Shrinkage limit **(6 marks)**

b) The results of a sieve analysis test for a soil sample are shown below:

| Sieve size (mm) | 50.0 | 37.5 | 20.0 | 10.0 | 63.0 | 5.0 | 3.4 | 2.0 | 1.2 | 0.9 | 0.6 | 0.2 | 0.2 | 0.1 | 0.1 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Mass retained (g) | 0.0 | 15. | 17. | 10. | 11.0 | 33. | 81. | 33. | 18. | 31. | 32. | 9. | 8. | 5. | 5.0 |

| | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 5 | 0 | 0 | | 0 | 0 | 5 | 0 | 0 | 5 | 0 | 0 | 5 | |

The total weight of the sample was 311g.

(i) Plot the particle size distribution curve and give a description of the soil (use chart 1)
(ii) Determine effective size and coefficient of uniformity. **(14 marks)**

**Question Four**

**a)** (i) Briefly describe the standard proctor compaction test. **(6 marks)**

(ii) Outline the factors affecting compaction **(6 marks)**

**b)** The following results were obtained from compaction test:

| Moisture Content (%) | 13 | 14 | 15 | 16 |
|---|---|---|---|---|
| Bulk Density ($kg/m^3$) | 2043 | 2100 | 2160 | 2117 |

**(i)** Plot the compaction curve
**(ii)** Determine the compaction parameters **(8 marks)**

**Question Five**

**a)** Explain FOUR factors that can influence permeability **(8 marks)**

**b)** Describe the four field tests for preliminary identification of fire grained soils. **(8 marks)**

**c)** Define consistency of soil **(4 marks)**