



# THE MOMBASA POLYTECHNIC UNIVERSITY COLLEGE

(A Constituent College of Jkuat)

*Faculty of Engineering and Technology*

DEPARTMENT OF BUILDING AND CIVIL ENGINEERING

**DIPLOMA IN ARCHITECTURE (DA 10A)**  
**DIPLOMA IN CIVIL ENGINEERING (DC 10A)**  
**DIPLOMA IN BUILDING & CIVIL ENGINEERING (DBC 10A)**

EBC 2216: SOIL MECHANICS I

**END OF SEMESTER EXAMINATION**

SERIES: AUGUST/SEPTEMBER 2011

**TIME: 2 HOURS**

## **Instructions to Candidates:**

You should have the following for this examination

- *Answer booklet*
- *Scientific Calculator*
- *3 No. graph papers*
- *Fig 1 casagrande chart*
- *Fig 2 (Plasticity Chart)*
- *Fig 3 (Particle size Distribution Chart)*

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 **FOUR** printed pages

## SECTION A (COMPULSORY)

### Question 1

- a) (i) Outline the importance of soil mechanics in regard to construction of building
- (ii) State the **FIVE** main factors upon which soil characteristics depend (8 marks)
- b) A laboratory test was carried out on a soil sample of specific gravity 2.65. The following results were obtained
- Mass of wet soil = 20.6KN
  - Mass of dried soil = 17.0KN

Calculate:

- (i) Saturated density of the sample
  - (ii) Porosity
  - (iii) Void ratio
  - (iv) Degree of saturation
  - (v) Critical hydraulic gradient (11 marks)
- c) (i) Define the term liquid limit
- (ii) The results obtained when an inorganic soil of plastic limit 27% was tested using Casagrande Apparatus were as shown in: Table 1

**Table 1**

TEST NUMBER	1	2	3
MOISTURE CONTENT (%)	50.65	50.38	50.12
NUMBER OF BLOWS	12	18	27

- Using fig 1 provided and results from Table 1, determine the liquid limit
  - Using the results obtained and fig 2 (plasticity chart), determine the group symbol for the soil tested (8 marks)
- d) State **THREE** factors that affect soil compaction (3 marks)

## SECTION B (Answer any TWO questions)

### Question 2

- a) Outline the sieve analysis test (6 marks)
- b) The results of a sieving analysis of a soil were as follows:

**Table 2**

Retained on sieve size (mm)	Weight retained (g)	Retained on sieve size (mm)	Weight retained (g)
20	0	2	3.5
12.5	1.7	1.4	1.1
10	2.3	0.5	30.5
6.3	8.4	0.355	45.3
5.6	5.7	0.180	25.4
2.8	12.9	0.063	7.4

The total weight of the sample was 147.2g.

- (i) Plot the particle-size distribution curve on fig 3 and; describe the soil
- (ii) State the effective grain size (14 marks)

**Question 3**

- a) Outline the standard Compaction test (7 marks)
- b) A standard proctor compaction test carried out on a sandy clay of specific gravity 2.55 gave the following results.

**Table 3**

Bulk Density (kg/m <sup>3</sup> )	2187	2160	2155	2140	2125	2058
Moisture content (%)	22	18.2	16.8	15.1	14.5	12.5

- i) Using graphical method, determine compaction parameters
- ii) Calculate the moisture content if the soil were compacted at 100% saturation to the maximum dry density (13 marks)

**Question 4**

- a) Explain **FOUR** factors that influence permeability (8 marks)
- b) Briefly describe the pumping test (5 marks)
- c) A variable head was made on a soil sample of length 350mm. The water level in a 30mm diameter stand pipe fell from 1650mm to 1100mm after 60seconds. Determine the coefficient of permeability of the soil if the diameter of the sample was 80mm (7 marks)

### Question 5

a) (i) Define the term shear strength

(ii) Define the **TWO** shear strength parameters

(6 marks)

b) In an undrained triaxial test on the specimens of a sandy clay soil taken from a depth of 3m below ground level the following results were obtained.

**Table 4**

Cell Pressure (KN/m <sup>2</sup> )	Deviator Stress KN/m <sup>2</sup>
200	221
400	362
600	505

Draw the Mohr's diagram and determine the shear strength parameters

(9 marks)

c) Briefly describe the unconfined compression test

(5 marks)