THE MOMBASA POLYTECHNIC UNIVERSITY COLLEGE

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

DEPARTMENT OF BUILDING AND CIVIL ENGINEERING

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

EBC 2216: SOIL MECHANICS

SPECIAL/SUPPLEMENTARY EXAMINATION

SERIES: FEBRUARY/MARCH 2012

TIME: 2 HOURS

<u>**Instructions to Candidates:**</u>
You should have the following for this examination
- *Answer Booklet*
- *Scientific Calculator*
- *2 No. Graph Papers*
- *Grading Chart*
- *Casagrande Chart*
- *Plasticity Chart*

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

SECTION A (COMPULSORY)

Question 1

a) (i) With the aid of a sketch, describe the falling head determination of coefficient of permeability for a fine-grained soil
   (ii) From basic principles, derive the equation for determining the coefficient of permeability of the soil for (i) above   (8 marks)

b) A clay soil has a bulk unit weight of $19.4KN/m^3$ and a moisture content of 24.3%. If the specific gravity of the soil particles is 2.75, determine:
   (i)   Dry unit weight
   (ii)   Void ratio
   (iii)   Degree of saturation
   (iv)   The saturated unit weight assuming that the void ratio remains constant   (12 marks)

c) Define the following terms a applied to shear strength:
   (i)   Principal plane
   (ii)   Principal stress   (2 marks)

d) In a series of unconsolidated-undrained tests on specimens of fully saturated clay, the following results were obtained at failure. Determine the values of shear strength parameters.   (8 marks)

All round pressure (KN/m²)	200	400	600
Principal stress difference (KN/m³)	222	218	220

Use graph paper provided.

SECTION B (Answer any TWO questions from this section)

Question 2

a) (i) Briefly describe the standard compaction test.
   (ii) The following results were obtained from a compaction test

Moisture content (%)	13	14	15	16
Bulk density (Kg/m3)	2043	2100	2110	2117

   Use the data provided to:
   -   Plot the compaction curve on a graph paper
   -   Determine the compaction parameter   (14 marks)

b) Outline **TWO** factors affecting compaction   (6 marks)

Question 3

a) The results obtained when an organic soil of plastic limit 27% was tested using casagrande apparatus were as shown in table below

Test no	1	2	3
Moisture content (%)	50.65	50.38	50.12
No. of Blows	12	18	27

    (i)   Determine the liquid limit (use figure 1)
    (ii)   Using results obtained in (i) and figure 2, classify the soil   (6 marks)

b) The results obtained from a sieve analysis on a soil sample are given in table below. If the total mass of the sample was 311g, plot the particle size distribution curve on Chart 1. From the curve, determine:
    (i)   The effective size and uniformity coefficient
    (ii)   Describe the soil and give the group symbol of classification   (14 marks)

Sieve size (mm)	Mass retained (g)
50	0
37.5	15.5
20	17.0
14	10.0
10	11.0
6.3	33.0
3.35	114.5
1.18	63.3
0.60	18.2
0.15	17.0
0.063	10.5

Question 4

a) Define the following terms as applied in soil mechanics:
    (i)   Degree of saturation
    (ii)   Bulk unit weight
    (iii)   Porosity   (4½ marks)

b) A sample of soil weighing 30.6kg had a volume of 0.0183m³. When dried an oven its weight reduced to 27.2 kg. If the specific gravity of the soil solids 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   (15½ marks)

Question 5

a) State **FIVE** factors upon which properties of soils are derived. (7½ marks)

b) A variable head was made on a soil sample of length 350mm. The water level is a 30mm diameter standpipe fell from 1650mm to 1100mm after 60seconds. Determine the coefficient of permeability of the soil if the diameter of the sample was 80mm (7½ marks)

c) A sample had a cohesion of $15KN/m^2$, internal angle of friction $21°$ and normal stress of $30KN/m^2$. Calculate the shear stress using Coulomb's equation. (5 marks)