THE MOMBASA POLYTECHNIC UNIVERSITY COLLEGE

(A Constituent College of JKUAT)

Faculty of Engineering and Technology

DEPARTMENT OF BUILDING AND CIVIL ENGINEERING

HIGHER DIPLOMA IN BUILDING & CIVIL ENGINEERING

EBC 3118: SOIL MECHANICS I

END OF SEMESTER EXAMINATION

SERIES: APRIL 2012

TIME: 2 HOURS

Instructions to Candidates:

You should have the following for this examination

- *Answer Booklet*
- *Graph Paper (2No)*
- *Plasticity Chart*

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

Question 1 (20 marks)

a) (i) Explain the term soil as used in civil engineering.

(ii) Determine the saturation capacity of a soil, given:

- Bulky density = 1.96g/cc
- Specific gravity of soil = 2.75
- Moisture content = 16% (6 marks)

b) Show from first principles the relationship between dry unit weight, moisture content and the bulk unit weight (4 marks)

c) Briefly explain the procedure for determining specific gravity of soil in the laboratory. (5 marks)

d) A fully saturated clay has a volume of 180cm^3 and weighs 320g. If the specific gravity of the soil particles is 2.6, determine:
(i) Void ratio
(ii) Porosity (5 marks)

Question 2 (20 marks)

a) A standard proctor compaction test carried out on a sandy clay of specific gravity 2.55 gave the following results

Bulky density (kg/m^3)	2187	2160	2155	2140	2125	2058
Moisture content (%)	22	18.2	16.8	15.1	14.5	12.5

(i) Using graphical method, determine the compaction parameters
(ii) Calculate the moisture content if the soil were compacted at 100% saturation to the maximum by density in 2(a) (i) (16 marks)

b) Outline **TWO** factors which affect compaction (4 marks)

Question 3 (20 marks)

a) An undisturbed soil sample subjected to a variable head permeability test had the following test details.
Length of sample = 200mm
Diameter of sample = 100mm
Diameter of standpipe = 2mm
Initial head = 450mm
Final head = 150mm
Time for drop in head = 10 minutes

A field permeability test on the same sample yielded the following data.

- Rate of pumping = 10m3/day
- Height of W.L above hard stratum in observation well 1 = 4m
- Height of W.L above hard stratum in observation well 2 = 8 m
- Radial distance to observation well 1 = 16m
- Radial distance to observation well 2 = 32m

(i) Calculate the coefficient of permeability in m/day for each of the tests
(ii) Outline at least **THREE** factors that influence deviations in test results from the **TWO** test methods. (15 marks)

b) Briefly describe the constant head permeameter test: (5 marks)

Question 4 (20 marks)

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

Cell pressure (KN/m^2)	**Deviator stress (KN/m^2)**
200	221
400	362
600	505

(i) Draw the Mohr's diagram and determine the shear strength parameters.
(ii) Obtain the Coulomb's equation for the soil. Take the density of soil as 2000kg/m^3 (10 marks)

b) Outline the procedure for carrying out vane test (5 marks)

c) A shear Vane apparatus was used to determine the undrained shear strength of a silt. The plates of the apparatus measured 12.7mm in height and 12.5mm in width. A torque of 0.45 x 10^{-3} KNm was applied. Calculate the undrained shear strength of the soil (5 marks)

Question 5 (20 marks)

a) Explain the following terms:
(i) Liquid limit
(ii) Plastic limit
(iii) Shrinkage limit (4½ marks)

b) The following results were obtained from a liquid limit test on a fine-grained soil.

Penetration (mm)	15.6	18.2	21.4	23.6
Moisture content (%)	48.6	54.6	62.2	67.4

A plastic limit test gave a value of 22%. What is the casagrande classification for this soil? Use the plasticity chart provided. (6½ marks)

c) Outline the sieve analysis test. (6 marks)
d) Define the following terms:
   (i) Effective size
   (ii) Uniformity coefficient (3 marks)