THE MOMBASA POLYTECHNIC UNIVERSITY COLLEGE

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

DEPARTMENT OF BUILDING AND CIVIL ENGINEERING

UNIVERSITY EXAMINATION FOR THE BACHELOR OF ENGINEERING IN BUILDING & CIVIL ENGINEERING (YR II SEM I)

EBC 4132: SOIL MECHANICS

SPECIAL/SUPPLEMENTARY EXAMINATION

SERIES: MAY/JUNE 2012
TIME: 2 HOURS

Instructions to Candidates:
You should have the following for this examination

- *Answer Booklet*

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

Question 1 (Compulsory – 30 marks)

a) Which are the **FOUR** field identification tests used to differentiate silt from clay (4 marks)

b) Name the **TWO** categories used to classify soils by civil engineers. (1 marks)

c) Define the terms porosity, void ratio and degree of saturation of a mass of soil. (6 marks)

d) What assumptions are made when applying Stohe's Law to determine particle size distribution by hydrometer analysis method? (4 marks)

e) Why is soil classification important in civil engineering? Name **FOUR** main system of soil classification (3 marks)

f) Outline the factors that affect permeability (8 marks)

g) Define a flownet. What are the properties of a flownet? (4 marks)

Question 2 (20 marks)

a) A soil sample in its natural state has a mass of 2.29 kg and a volume of $1.15 \times 10^{-3}\ m^3$. Under an oven dried state, the dry mass of the sample is 2.035kg. The specific gravity of the solids is 2.68. Determine the:

   i) Total density (2 marks)
   ii) Water content (2 marks)
   iii) Void ratio (2 marks)
   iv) Porosity (2 marks)
   v) Degree of saturation (2 marks)

b) Briefly discuss of the consistency of soils as per Atterberg limits (10 marks)

Question 3 (20 marks)

a) Briefly discuss the determination of grain size distribution in soils by sieve analysis (6 marks)

b) In a Hydrometer Analysis, particles of five different sizes are mixed and enough water added to make $1000cm^3$ of suspension. The temperature of the suspension is 20°C. Viscosity, $\mu = 1.11 \times 10^{-5}\ g.s/cm^2$. Proportions are shown below:

Particles size (mm)	Weight (g)
0.050	6
0.020	20
0.010	15
0.005	5
0.001	4

Total **50**

$\mu s = 2.70$ *and* $\omega = 1.0 g/cm^3$

Take

i) What is the largest particle size present at a depth of 6cm, 8 mins after start of sedimentation (3 marks)

ii) What is the μs of the suspension at a depth of 6cm, 8 mins after sedimentation (4 marks)

iii) How long should the sedimentation be allowed until all the particles have settled below 6cm (3 marks)

iv) Briefly discuss the following grain shape properties
- Bulky
- Flaky (4 marks)

Question 4 (20 marks)

a) Define shear strength of soils (2 marks)

b) What properties affect the shearing characteristics of a soil? (3 marks)

c) Outline the derivation of the coulomb equation (coulombs law). List the most important factors that this law depends on (10 marks)

d) Outline the Mohr-Coulomb failure theory (5 marks)

Question 5 (20 marks)

a) Define seepage through soils (3 marks)

b) Give examples where seepage problems can occur (4 marks)

c) Outline what hydraulic gradient in isotropic, homogeneous soils is (3 marks)

d) Briefly discuss the constant head permeability test for determination of coefficient of permeability (10 marks)