



THE MOMBASA POLYTECHNIC UNIVERSITY COLLEGE

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

DEPARTMENT OF BUILDING AND CIVIL ENGINEERING

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

EBC 4132: 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*

This paper consists of **FIVE** questions in **TWO** sections **I & II**

Answer question **ONE (Compulsory)** and any other **TWO** questions

Maximum marks for each part of a question are clearly shown

This paper consists of **THREE** printed pages

SECTION I (Compulsory)

Question 1

- Outline the **FOUR** field identification tests that are used to differentiate silt from clay (4 marks)
- What **TWO** distinct categories are used to classify soils by civil engineers (1 mark)
- Define the terms **porosity**, **void ratio** and **degree of saturation** of a soil mass (3 marks)
- State Stoke's Law. What assumptions are taken into consideration when applying Stoke's Law to determine particle size distribution by hydrometer analysis method (5 marks)
- Why is soil classification important in civil engineering? List the **FOUR** systems of soil classification. (3 marks)
- Briefly discuss the factors that affect permeability (8 marks)
- What is a flow net? State the properties of a flow net (3 marks)
- What is soil compaction? What **TWO** main factors affect soil compaction (3 marks)

SECTION II (Answer any TWO questions)

Question 2

a) A soil sample in its natural state has a mass of 2.29kg and a volume of $1.15 \times 10^{-3} \text{m}^3$ 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 the consistency of soils as per Atterberg limits (10 marks)

Question 3

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

b) In a Hydrometer Analysis, particles of 5 different sizes are mixed and enough water added to make 1000cm^3 of suspension. The temperature of the suspension is 20°C . Viscosity Proportions are shown below:

Particle size (mm)	(weight (g))
0.050	6
0.020	20
0.010	15
0.005	5
0.001	<u>4</u>
Total	50

$$G_s = 2.70 \quad \gamma_w = 1.0 \text{g/cm}^3$$

Take and

- (i) What is the largest particle size present at a depth of 6cm, 8 minutes after start of sedimentation? (3 marks)
- (ii) What is the G_s 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)

c) Briefly discuss the following grain shape properties

- (i) Bulky
- (ii) Flaky (4 marks)

Question 4

- 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 (Coulomb's law). List the most important factors that this law depends on (10 marks)
- d) Outline the Mohr-Coulomb failure theory (5 marks)

Question 5

- 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)