



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 SCIENCE IN CIVIL ENGINEERING

ECE 2303: SOIL MECHANICS 1

SPECIAL/SUPPLEMENTARY EXAMINATION

SERIES: OCTOBER 2011

TIME: 2 HOURS

Instructions to Candidates:

You should have the following for this examination

- *Answer booklet*
- *Semi-log graph papers and ONE Cartesian graph paper*

This paper consists of **FIVE** questions. Answer question **ONE (COMPULSORY)** from section **A** and any other **TWO** from section **B**

Maximum marks for each part of a question are as shown

This paper consists of **THREE** printed pages

SECTION A (COMPULSORY – 30 MARKS)

Question 1

- Briefly highlight **FOUR** field identification tests that differentiate silt from clay (4 marks)
- What are the **TWO** distinct categories of soils that are important to a civil engineer(1 mark)
- Define the terms porosity, void ratio and degree of saturation for a soil mass (3 marks)
- State Stoke's Law. In using the Stoke's Law in determining particle size distribution by Hydrometer and Pipette analysis, which assumptions are taken into considerations

- (5 marks)
- e) What do you understand by Atterberg's Limits? Highlight on the three Atterberg's Limits (4 marks)
- f) Why is soil classification important? List any **FOUR** Systems of soil classification (3 marks)
- g) Briefly discuss the variables on which permeability of a given soil depends (4 marks)
- h) State the properties of flow net and its application (3 marks)
- i) What is soil compaction? State the factors affecting soil compaction (3 marks)

SECTION B (Attempt any TWO questions from this section – 20 marks each)

Question 2

- a) A soil sample of moist silty soil has a volume of 15cm^3 and weighs 28g. After complete drying out in oven, its weight is 24g. The unit weight of solid constituents is 2.7g/cm^3 . Calculate:-
- Void ratio (2 marks)
 - Porosity (2 marks)
 - Water content (2 marks)
 - Degree of saturation (2 marks)
- b) Results obtained in consistency limits test for two soils are given below:

Soil X		Soil Y	
4	48	7	61
10	43	15	59
20	40	25	58
40	36	40	57
$P_w = 20\%$		$P_w = 20\%$	
$W_n = 42\%$		$W_n = 58\%$	

- Determine plasticity index for the soils (1 mark)
- Which soil is a better foundation material (2 marks)
- Comment on the strength of the soils (2 marks)
- Comment on the strength of the soils at plastic limit (2 marks)
- Do these soil materials have organic matter? Comment (1 mark)

Question 3

- a) Write briefly on 'A. Casagrande's Soil Classification System' (5 marks)
- b) In determination of particle size distribution, the following data was obtained

Sieve size, mm	9.40	4.75	2.00	0.42	0.25	0.105	0.074	0.05	0.005	0.001
% finer	100	90	72	67	56	44	24	21	11	4

- i) Plot a grain size distribution curve (5 marks)
 - ii) Determine the co-efficient of uniformity and curvature (4 marks)
- c) In a test, 10g of fine grained soil of specific gravity of 2.70 was dispersed in 500cm³ of water in a jar (viscosity = 1.1×10^{-5} g.s/cm²). A sample of volume 10cm³ was taken by means of pipette at a depth of 10cm, 46 minutes after sedimentation. The sample after oven drying, weighed 0.026g. Calculate:-
- i) The largest particle remaining in suspension at 10cm depth (3 marks)
 - ii) The percentage finer than this size in the original soil (3 marks)

Question 4

- a) Describe a falling head permeameter test and show pertinent derivations for the determination of co-efficient of permeability (10 marks)
- b) A sample of soil 8cm in diameter and 4cm thick is tested in a falling head permeameter. The elevation of water in the standpipe above the tail water level was observed to drop from 42cm to 32cm in 5 minutes, 42 seconds permeability and classify the soil (5 marks)
- c) A concrete dam, 150m long has a sheet pile that extends half way down a permeable stratum. The head of the dam is 10cm. From a flow net made up square figures, there are 5 seepage paths and 15 equipotentials drops. The co-efficient of permeability is 1×10^{-4} cm/sec. What will be the quantity of seepage in m/day? (5 marks)

Question 5

- a) Develop a relationship for void ratio in terms of specific gravity and water content for a saturated soil (3 marks)
- b) Describe the Standard Proctor Compaction Test for a soil sample (5 marks)
- c) The following data were recorded in Standard Proctor Test for a soil sample picked from a highway embankment. The specific gravity of the soil is 2.75.

Water content %	11.4	12.8	15.8	18.6	19.8
Wet density g/cm ³	1.9	1.96	2.07	2.05	2.03

- i) Plot the dry density versus moisture content curve and determine the optimum moisture content and maximum dry density (8 marks)
- ii) At this optimum moisture content and maximum dry density, calculate the void ratio and degree of saturation. Make a comment (4 marks)