



THE MOMBASA POLYTECHNIC UNIVERSITY COLLEGE

University Examination 2010

THIRD YEAR/FIRST SEMESTER EXAMINATION FOR THE DEGREE IN BACHELOR OF SCIENCE IN CIVIL ENGINEERING

ECE 2303: SOIL MECHANICS I

SERIES: APRIL/MAY 2010

TIME: 2 HOURS

Instructions:

Answer Question **ONE** and any other **TWO** questions.

Check that you have **TWO** semi-log graph papers and **ONE** Cartesian graph paper.

QUESTION ONE (Compulsory)

- (a) Briefly highlight **FOUR** field identification tests that differentiate silt from clay (4 marks)
- (b) What are the **TWO** distinct categories of soils that are important to a civil engineer? (1 mark)
- (c) Define the terms porosity, void ratio and degree of saturation for a soil mass. (3 marks)
- (d) 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 a flow net and its application. (3 marks)
- (i) What is soil compaction? State the factors affecting soil compaction. (3 marks)

QUESTION TWO

- (a) A soil sample of moist silty soil has a volume of 15cm³ and weighs 28g. After complete drying out in oven, its weight is 24g. The unit weight of solid constituents is 2.7g/cm³. Calculate:-
- (i) Void ratio (2 marks)
- (ii) Porosity (2 marks)
- (iii) Water Content (2 marks)
- (iv) Degree of saturation (2 marks)
- (b) Results obtained in consistency limits test for two soils are given below.

Soil X		Soil Y	
No. of blows	Water content %	No. of blows	Water content %
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%	

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

QUESTION THREE

- (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 x 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 FOUR

- (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. The inside diameter of standpipe is 0.2cm. Compute the co-efficient of 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 16 equipotentials drops. The co-efficient of permeability is 1x10⁻⁴ cm/sec. What will be the quantity of seepage in m/day? (5 marks)

QUESTION FIVE

- (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 ration and degree of saturation. Make a comment. (4 marks)