



# TECHNICAL UNIVERSITY OF MOMBASA

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FACULTY OF ENGINEERING AND TECHNOLOGY  
DEPARTMENT OF BUILDING & CIVIL ENGINEERING

**UNIVERSITY EXAMINATION FOR:**

**BACHELOR OF SCIENCE IN CIVIL ENGINEERING  
(INSTITUTION BASED EXAMINATION)**

**ECE 2303 : SOIL MECHANICS I**

**END OF SEMESTER EXAMINATION**

**SERIES: MARCH 2017**

**TIME: 2 HOURS**

**Instructions to Candidates**

You should have the following for this examination

*-Answer Booklet, examination pass and student ID*

This paper consists of five questions.

Attempt question ONE (Compulsory) and any other TWO questions.

**Do not write on the question paper.**

**QUESTION ONE (COMPULSORY)**

- a) Briefly discuss the importance of soil mechanics in civil engineering. (5marks)
- b) Define consistency of clay soils. (4marks)
- c) Outline THREE factors that affect soil compaction. (3marks)
- d) Particle size distribution analysis carried out on a soil using the dry sieving technique yielded the follow results:

Best test sieve size (mm)	Mass of the soil retained(g)
3.35	0
2.00	45.98
1.18	56.19
0.600	117.50
0.425	61.30
0.300	58.50
0.212	43.67
0.150	66.42
0.063	51.08

The total mass of the sample used was 510.86g

- (i) Calculate and tabulate data for particle size analysis and use it to draw the particle size distribution curve. (9marks)
  - (ii) Calculate the coefficient of uniformity. (3marks)
  - (iii) Determine particle size sub ranges and describe the soil. (2marks)
- b) Classify the soil based on the Unified soil classification system. (2marks)

### QUESTION TWO

- a) Briefly describe the simple field tests that can be used to identify clay and silt. (8 marks)
- b) Distinguish between Residual and Transported soils. (4 marks)
- c) The moisture content of an undisturbed sample of clay from a volcanic region is 265%, under 100% saturation. The specific gravity of the solids is 2.5. The dry unit weight is 3.3 KN/m<sup>3</sup>. Determine; (6 marks)
  - (i) The saturated unit weight.
  - (ii) Submerged unit weight.
  - (iii) Void ratio
- d) Define Soil compaction. (2 marks)

### QUESTION THREE

- a) Explain FOUR factors that influence permeability. (8 marks)
- b) Outline the standard proctor compaction test. (8 marks)
- c) Permeability of a soil 75 mm diameter and 60 mm long was tested using the constant head method. The head causing flow was 83 mm when 120cm<sup>3</sup> of water was collected in 14 seconds. Calculate coefficient of permeability for the soil tested. (4marks)

#### QUESTION FOUR

- a) Define soil mechanics. (2 marks)
- b) Using particle size distribution curves, describe FOUR important features of a soil. (8 marks)
- c) A clay soil sample is compacted at a moisture content of 18% bulk density of  $1.86 \text{ Mg/m}^3$ . The particle specific gravity of the soils is 2.73. Determine the following:
  - i) Dry density
  - ii) Air voids ratio
  - iii) Calculate the percentage of air voids if the soil were to compacted at a moisture of 25%.
  - iv) Briefly explain the difference between the results obtained based on compaction concepts. (10marks)

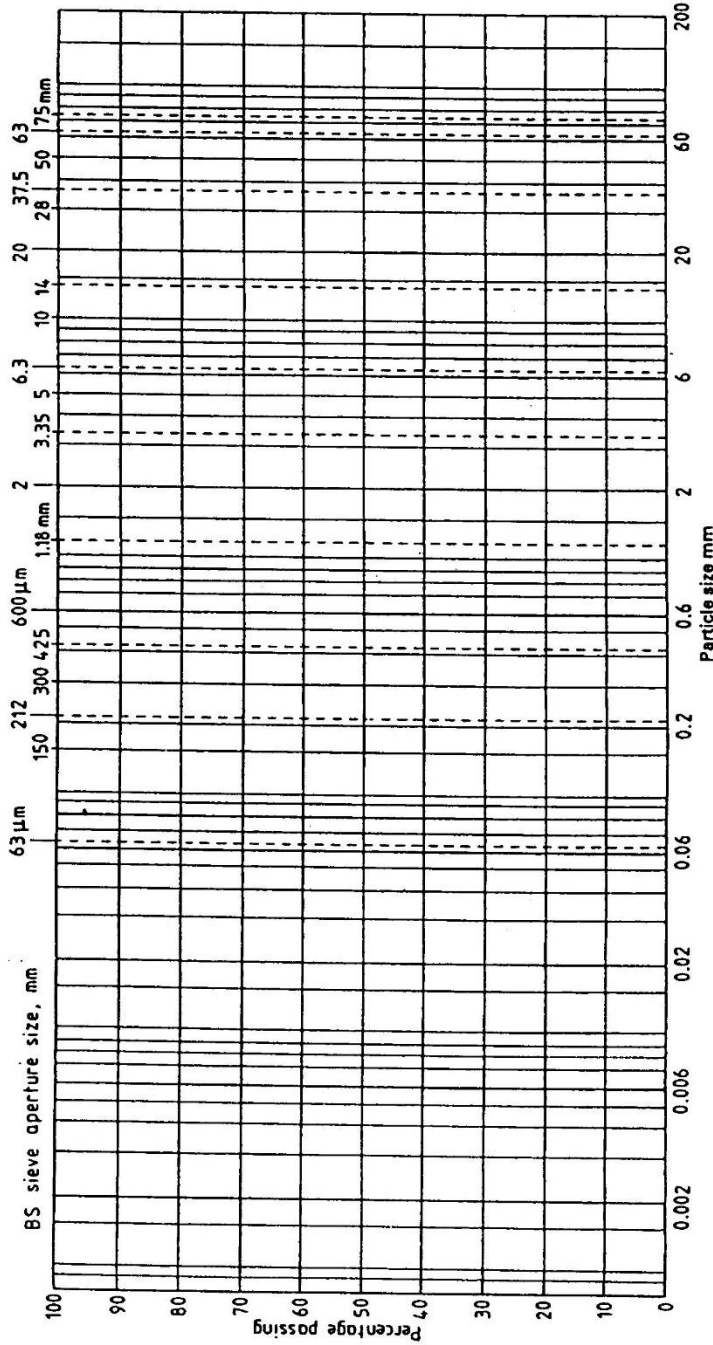
#### QUESTION FIVE

- a) Briefly discuss consistency limits. (10marks)
- b) A soil deposit when in a loose state has 48% porosity but when dense its porosity is 42%. The particle specific gravity of the soil is 2.68. Calculate the increase in hydraulic gradient for the soil when its state changes from loose to dense. (5marks)
- c) Explain the effects of “Piping” in dams. (5marks)

Particle size distribution chart

Form 2.N

Location	Soil description	Job ref.	Sample no.
Test method	BS 1377-2:1990-9.2/9.3/9.4/9.5*	Borehole/Pit no.	Depth
			Date
			m



Fine	Medium	Coarse	Fine	Medium	Coarse	COBBLES	BOULDERS	
CLAY	SILT		SAND		GRAVEL			
Operator							Checked	Approved

\*Delete as appropriate

