TECHNICAL UNIVERSITY OF MOMBASA.

FACULTY OF ENGINEERING AND TECHNOLOGY

DEPARTMENT OF BUILDING AND CIVIL ENGINEERING

UNIVERSITY EXAMINATION FOR

BACHELOR OF SCIENCE IN CIVIL ENGINEERING.

ECE 2303: SOIL MECHANICS I

DECEMBER 2016

Question One (Compulsory)   **(30marks)**

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)   A sand sample with 35cm^2 cross sectional area and 20cm long was tested in a constant head permeameter. Under a head of 60cm, the discharge was 120ml in 6 min. the dry weight of sand used was 1120g and Gs = 2,68. Determine ;
   i)   The coefficient of permeability in cm/sec.
   ii)   The discharge velocity
   iii)   The seepage velocity.   (6marks)
e) Define the following geotechnical properties; i) Void ratio. ii) Porosity. Iii) Water content iv) Degree of saturation.   (4marks)
f) A sample of saturated clay has a mass of 1.526 kg. and a dry mass of 1.053kg. the specific gravity of the solid particles is 2.7. For the sample, determine;
   i)   Water content
   ii)   Void ratio
   iii)   Porosity
   iv)   Total density.   (8marks)

Question Two

a)   Outline the sieve analysis test.   **(6 marks)**

b)   The results of a sieving analysis test were as follows

Sieve Size (in mm)	Weight Retained (in g)
20	0
12.5	1.7
10	2.3
6.3	8.4
5.6	4.7
2.8	12.9
2	3.5
1.4	1.1
0.5	30.5
0.355	45.3
0.180	25.4
0.063	7.4

The total weight of the sample was 147.2 g:

(i) Plot the particle size distribution curve on the chart 1 provided and describe the soil

(ii) State the effective grain size. **(14 marks)**

Question Three

a) Explain FOUR factors that influence permeability. **(8 marks)**

b) Outline the standard proctor compaction test **(8 marks)**

c) A saturated sample of undisturbed clay has a volume of 19.2 cm³ and a weight of 32.5 g. After oven drying, the weight reduces to 20.2g. Determine:

i) Water content

ii) Specific gravity

iii) Void ratio **(4 marks)**

Question Four

a) State Stoke's Law **(2 marks)**

b) Outline the assumptions taken when applying Stoke's Law. **(4 marks)**

c) Using particle size distribution curve describe FOUR important features of a soil **(8 marks)**

d) Specific gravity for a soil was obtained in a laboratory test. the following measurements were made; M_s = 100g, M_{1} = 608g, M_2 = 550g. By over sight, 2cm³ of air remained entrapped in the suspension when the weight M, was taken.

(i) Will the value of Gs be lower or higher than the true value? Compute.

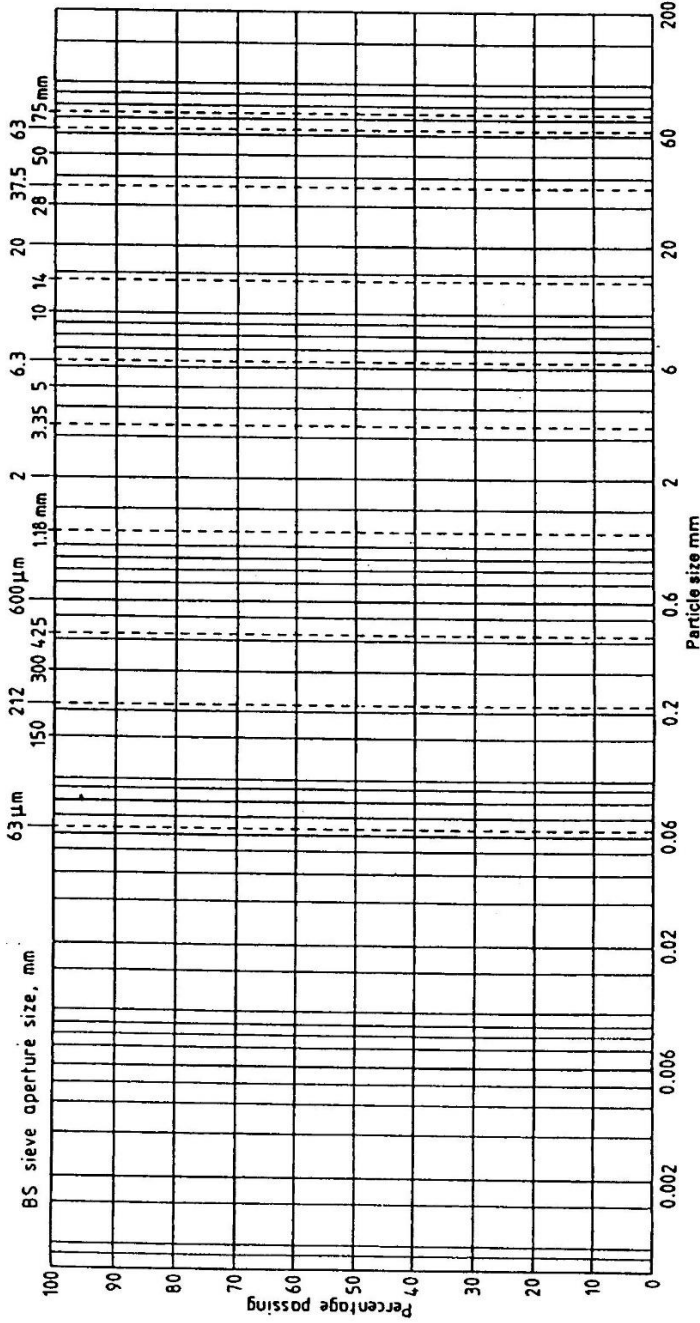(ii) Calculate the percentage error **(6 marks)**

Question Five (20marks)

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$^{3.}$ Determine

    (i)   The saturated weight unit

    (ii)   Submerged weight unit

    (iii)   Void ratio (**6 marks**)

d) Define Soil compaction. (**2 marks**)

Particle size distribution chart

Form 2.N

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

Percentage passing

BS sieve aperture size, mm

Particle size mm

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

*Delete as appropriate