



**MURANG'A UNIVERSITY COLLEGE**

*(A constituent college of Jomo Kenyatta University of Agriculture & Technology)*

**BUILDING AND CIVIL ENGINEERING DEPARTMENT**

**MRUC DIPLOMA IN CIVIL ENGINEERING**

**END OF SEMESTER EXAMINATION**

**2014/2015 ACADEMIC YEAR**

**CLASS: BC/C/14 D -MAY 2014 INTAKE**

**UNIT TITLE: SOIL MECHANICS I**

**UNIT CODE: SEB 1231**

**TIME: 2 HRS**

*Instructions*

- **This paper consists of Five Questions**
- **Attempt Question One (compulsory) and any other two.**

**Q1                    COMPULSORY (30 marks)**

- a) Define the following terms;
- (i) Consolidation
  - (ii) Comp active effort
  - (iii) Porosity
  - (iv) Permeability
  - (v) Void ratio (5mks)
- b) From basic principles, show that :
- (i) Void ratio =  $\frac{n}{1-n}$  ; where n is the porosity.
  - (ii) Porosity =  $\frac{e}{1+e}$  ; where e is the void ratio. (4 marks)
- c) A sample of soil weighing 30.8kg had a volume of 0.0193m<sup>3</sup> when oven dried its mass was reduced to 27.4kg. if the specific gravity of the solids was found to be 2.65, determine the following:
- i. Bulk density
  - ii. Dry density
  - iii. Percentage moisture content
  - iv. Saturated density
  - v. Percentage air voids. (13 marks)
- d) Outline four factors that affect the angle of shearing resistance. (4 marks)
- e) State four properties of a soil that can be improved by compaction. (4 marks)

- Q2.** (a) With the aid of a sketch, describe the constant head permeameter test. (10 mark  
(b)(i) Using Darcy's law, derive an expression for the coefficient of permeability;

(ii) Determine the coefficient of permeability of a sample of sand given the following data:

- diameter of permeameter=75mm
- loss of head on a 200mm length ==86.2mm
- water collected in 1 minute=67.8ml. (7 marks)

(c) Define the following terms:

- (i) Hydraulic gradient
- (ii) Piping
- (iii) Vadose water (3mks)

**Q3** (a) With the aid of an illustration explain the meaning of the following terms;

- (i) Liquid limit
- (ii) Plastic limit
- (iii) Shrinkage limit
- (iv) Plasticity index (6mks)

(b) Describe one method of determining the liquid limit of a given sample. (6 marks)

(c) The results of a compaction test are given in table 1. Plot the dry density – moisture Content curve and determine the maximum dry density and optimum moisture Content.

Table 1

Bulk density (Kg/M <sup>3</sup> )	1790	1990	2140	2100	2060	2020
Moisture content (%)	7.7	11.5	14.6	17.5	19.7	21.2

(8 marks)

**Q4.** (a) Briefly describe one method of determining the distribution of grain sizes present in a soil sample. (6 mks)

(b) After carrying out a sieve analysis test, the following results were obtained.

Sieve size	Mass of sample retained(g)
100 mm	-
63 mm	-
37.5 mm	30.0
20 mm	75.0
10 mm	140.0
5 mm	160.0
2 mm	180.0
1.0 mm	120.0
500µm	104.0
300 µm	86.0
150 µm	45.0
75 µm	60.0

(i) Plot the grading curve for the soil. (6 mks)

(ii) Determine the coefficient of uniformity and the coefficient of curvature for the soil.

(.6 mks)

(iii) Describe the soil.

(2mks)

**Q5.** (a) Outline **Four** factors that affect coefficient of permeability (k) (4 mks)

(b) Briefly readings were taken in a shear box test on compacted sand;

Normal load (N)	90	225	350
Shear load(N) (Peak)	85	215	343
Shear load (N) Ultimate	55	143	230

The shear box measured 60mm square.

Find the angle of shearing resistance.

(i) In the compacted state

(ii) In the loose state. (10 mks)

(c) State three applications of flow nets. (3 mks)

(d) With the aid of a sketch explain the meaning of the term flow net. (3 marks)