



**JARAMOGI OGINGA ODINGA UNIVERSITY OF SCIENCE AND  
TECHNOLOGY**

**UNIVERSITY EXAMINATIONS 2012/2013**

**2<sup>ND</sup> YEAR 1<sup>ST</sup> SEMESTER EXAMINATION FOR THE DIPLOMA  
IN BUILDING AND CIVIL ENGINEERING**

**COURSE CODE: TBC 2215**

**COURSE TITLE: SOIL MECHANICS AND FOUNDATION ENGINEERING  
I**

**DATE: 19/4/2013**

**TIME: 11.00-12.30PM**

**DURATION: 1.5 HOURS**

**INSTRUCTIONS TO CANDIDATES**

**This paper consists of 5 questions**

**Answer Question ONE and any other TWO Questions**

### QUESTION ONE

- a) Define soil from the perspective of a civil engineer and describe the THREE formation processes.  
( 6 Marks)
- b) State any TWO reasons why a better understanding of soil properties is necessary in constructing building and civil engineering works.  
(4 Marks)
- c) Distinguish between the following pairs of terms:  
i. Void ratio and porosity  
ii. Degree of saturation and water content.  
( 6 Marks)
- d) A soil sample in its undisturbed state was found to have volume of  $105\text{cm}^3$  and mass of 201g. After oven drying the mass got reduced to 168g. Taking specific gravity of the soil grains as 2.7, compute:  
i. Water content  
ii. Void ratio  
iii. Porosity  
iv. Degree of saturation  
( 8 Marks)
- e) Define the following Atterberg limits  
i. Liquid limit  
ii. Plastic limit  
iii. Shrinkage limit  
(6Marks)

### QUESTION TWO

- a) Distinguish between compaction and consolidation  
( 2 Marks)
- b) State any FOUR effects compaction has on the properties of soil  
(4 Marks )
- c) A small cylinder having volume of 600cc is pressed into recently compacted fill of embankment, filling the cylinder. The weight of the soil filled in the cylinder is 1100g. the dry weight of the soil is 910g. determine void ratio and saturation of the soil. Take specific gravity of the soil grains as 2.7.  
( 9 Marks)

### QUESTION THREE

- a) Define Darcy's Law  
(2 Marks)
- b) State any FOUR factors affecting permeability of soils  
(4 Marks)
- c) A falling head permeability test was performed on a sample of clean uniform sand. The initial hydraulic head was 900mm, the final head was 400mm and 60s was required for the water level in the standpipe to fall. The cross sectional area of the

standpipe was 100mm<sup>2</sup>. The sample was 40mm diameter and had a length of 180mm. determine the coefficient of permeability in Darcy's law.

(9 Marks)

#### QUESTION FOUR

a) State Mohr-Coulomb theory for soil shear strength.

(5 Marks)

b) Shown in Table 1 are data obtained from a direct shear test conducted on samples of compacted sand. The shear box dimensions are 60mm by 60mm. Determine peak and ultimate angles of shearing resistance of sand.

Table 1

Normal load (N)	Shear stress load at failure (N)	
	Peak	Ultimate
30.5	26.4	18.0
62.5	54.2	37.5
94.4	81.2	55.5

(10 Marks)

#### QUESTION FIVE

(a) Explain the consolidation phenomena using spring analogy.

(7 Marks)

(b) List any FOUR possible causes of consolidation in soils

(4Marks )

(c) Distinguish between normally and over consolidated soils

(4 Marks)