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

**UNIVERSITY EXAMINATIONS** **2013/2014 ACADEMIC YEAR**

**SECOND YEAR, FIRST SEMESTER FOR THE DEGREE OF BACHELOR OF SCIENCE IN CONSTRUCTION MANAGEMENT**

**TCM- 3211 SOIL MECHANICS**
**August 2013** **TIME: 2 HOURS**

**INSTRUCTIONS TO CANDIDATES**
**This paper consists of 5 questions**
**Answer Question ONE and any other TWO Questions**

## QUESTION ONE

a) State any TWO reasons why a better understanding of soil properties is necessary in constructing of building and civil engineering works.

(4 Marks)

b) A soil mass has a bulk unit weight of 20kN/$m^3$ with water content of 19%. Taking specific gravity of the soil grains as 2.7, compute:

i. Dry unit weight
ii. Void ratio
iii. Porosity
iv. Degree of saturation
v. Submerged unit weight

( 10 Marks)

c) State SIX factors affecting permeability of soils

(6 Marks)

d) Define the following Atterberg's limits

i. Liquid limit
ii. Plastic limit
iii. Shrinkage limit

(6Marks)

e) State any TWO methods of soil site investigation

(4 Marks)

## QUESTION TWO

a) Distinguish between compaction and consolidation

( 4 Marks)

b) Distinguish between normally consolidated and over consolidated soils

(4 Marks )

c) In a standard Proctor's Test, the mould of 1 liter capacity weighs 12.5N when empty. Successive trials gave results shown in Table 1. Determine the following:

i. Optimum moisture content
ii. Degree of saturation at maximum dry density.

**Table 1**

| | | | | | |
|---|---|---|---|---|---|
| Weight of mould+weight of soil(N) | 29.6 | 30.1 | 31.5 | 31.2 | 30.8 |
| Water content (%) | 16.7 | 18.6 | 21.0 | 21.7 | 23.5 |

( 12 Marks)

## QUESTION THREE

a) State any FOUR applications for earth retaining structures in highway construction

(4 Marks)

b) List any FOUR types of earth retaining structures

(4 Marks)

c) A retaining wall with vertical back is 8m high. The density of the top 3m of fill is 17.15kN/$m^3$ and the angle of friction is $30^0$; for the lower 5m, the values are

$18.12kN/m^3$ and $35^0$ respectively. There is a surcharge load on the horizontal surface of the fill equivalent to $11.8kN/m^2$. Find the magnitude and point of application of the active thrust on the wall per lineal meter.

(12 Marks)

## QUESTION FOUR

a) In reference to shear strength of soils, state Mohr's- Coulomb theory.

(4 Marks)

b) State any FOUR advantages of triaxial compression test over direct shear test.

(4 Marks)

c) The results indicated in Table 2 were obtained from undrained shear box tests on specimens of sandy clay. The cross-section of the shear box was 60mmx60mm.

**Table 2**

| | | | |
|---|---|---|---|
| Normal load (N) | 200 | 400 | 800 |
| Shear force at failure(N) | 204 | 260 | 356 |

If a specimen of the same soil is tested in triaxial compression with a cell pressure of $100\ kN/m^2$, determine the total axial stress at which failure will be expected to occur.

(12 Marks)

## QUESTION FIVE

a) Distinguish between shallow and deep foundation.

(2 Marks)

b) Distinguish between safe bearing capacity and allowable bearing capacity of soils

(4 Marks)

c) Define soil stabilization and explain its purpose in construction process.

(4Marks )

d) Explain why knowledge of position of groundwater table at a site is important before implementation of construction projects.

(4 Marks)

e) Compute the ultimate bearing capacity of a strip footing of width 1.0m and 0.5m below the surface of a moist soil having cohesion of $0.2kg/cm^2$ and angle of internal friction $36^0$. Assume the density of soil 2g/cc and the bearing capacity factors as Nc=48, Nq=35, $N\gamma$ =42. Also calculate safe bearing capacity if the factor of safety is 2.5.

(6 Marks)