MERU UNIVERSITY OF SCIENCE AND TECHNOLOGY

P.O. Box 972-60200 – Meru-Kenya.
Tel: 020-2069349, 061-2309217. 064-30320 Cell phone: +254 712524293, +254 789151411
Fax: 064-30321
Website: www.must.ac.ke Email: info@must.ac.ke

University Examinations 2013/2014

SECOND YEAR, FIRST SEMESTER EXAMINATION FOR DIPLOMA IN CIVIL ENGINEERING

ECV 0224: SOIL MECHANICS I

DATE: APRIL 2014 **TIME: 1 ½ HOURS**

INSTRUCTIONS: *Answer question **one** and any other **two** questions*

QUESTION ONE – (30 MARKS)

(a) Define the following terms as applied in soil
   (i) Percentage air voids
   (ii) Specific gravity of soil particles
   (iii) Degree of saturation
   (iv) Moisture content (4 Marks)

(b) Define the term compaction. (2 Marks)

(c) A sample of moist soil has a volume of 14.88cm^3 and weighs 28.81g. After complete drying out in an oven its weight is 24.83g. The density of solid particles is 2.7g/cm^3. Calculate:
   (i) The void ratio (3 Marks)
   (ii) Degree of saturation (3 Marks)
   (iii) Percentage air voids (2 Marks)

(d) Working from basic principles show that the expression for dry density of soil is given by $\gamma_d = \frac{G_s \gamma_w (1 - V_a)}{1 + mG_s}$ where V_a = air content. (4 Marks)

(e) In a sample of clay, the void ratio is 0.73 and the specific gravity of the particles is 2.68. If the voids are 85% saturated, determine:
   (i) Bulk density (2 Marks)
   (ii) The dry density (2 Marks)
   (iii) The percentage moisture content (2 Marks)

(f) Define permeability. (2 Marks)

(g) State two methods of determining coefficient of permeability. (2 Marks)

(h) Show that $\gamma_d = \frac{\gamma_b}{1+m}$ (2 Marks)

QUESTION TWO – (15 MARKS)

(a) Derive from basic principles the equation for the coefficient of permeability in a variable head permeameter. (5 Marks)

(b) In a falling head permeameter, the head falls from 400mm to 250mm in a stand pipe of diameter 3.5mm. The sample through which water flows has a depth of 100mm and diameter of the sample is 75mm. If $K = 2 \times 10^{-4} mm/s$, determine the time required in minutes for water to fall from 400mm to 250mm in the stand pipe. (5 Marks)

(c) A graded filter is constructed of 4 layers of soil. The layers are 8m, 1m, 6m and 10m thick and compacted to give permeabilities of $3 \times 10^{-4} cm/s$,$2.5 \times 10^{-8} cm/s$, $8 \times 10^{-3} cm/s$, and $7.2 \times 10^{-2} cm/s$ respectively. Calculate the average coefficient of permeability in direction parallel to and at right angles to the layers. (5 Marks)

QUESTION THREE – (15 MARKS)

In a standard compaction test on a soil $(G_s = 2.68)$ the following results were obtained:

Water content (%)	Bulk Density (Kg/m^3)
2	2019.60
4	2138.24
6	2230.24
8	2278.80
10	2255.00
12	2228.80

Draw a graph of dry density against moisture content and determine the:

(a) Maximum dry density

(b) Optimum moisture content

(c) Air content at the maximum dry density (15 Marks)

QUESTION FOUR – (15 MARKS)

(a) A soil sample had a mass of 0.82Kg. After drying completely its mass was 0.72Kg. If the specific gravity of the solids was 2.65 and the sample size was 75mm diameter and 150mm long, calculate:

(i) Bulk density
(ii) Moisture content
(iii) Void ratio
(iv) Porosity
(v) Air porosity
(vi) Saturated unit weight (12 Marks)

(b) A soil sample weighs 4.15kg. The volume and moisture content of the soil are $0.0025m^3$ and 15% respectively. Calculate the void ratio. Take solid particle specific gravity as 2.69. (3 Marks)