TECHNICAL UNIVERSITY OF MOMBASA

Faculty of Engineering & Technology

DEPARTMENT OF BUILDING & CIVIL ENGINEERING

UNIVERSITY EXAMINATION FOR BACHELOR OF SCIENCE IN CIVIL ENGINEERING (BSCE 13M)

ECE 2303: SOIL MECHANICS I

END OF SEMESTER EXAMINATION
SERIES: AUGUST 2013
TIME ALLOWED: 2 HOURS

Instructions to Candidates:
You should have the following for this examination
- *Answer Booklet*

This paper consists of **FIVE** questions.
Answer question **ONE (COMPULSORY)** in section **A** and any other **TWO** questions from section **B**
Maximum marks for each part of a question are as shown
This paper consists of **THREE** printed pages

SECTION A

Question One (Compulsory)

a) Briefly explain how soil is formed. **(4 marks)**

b) What are the **TWO** broad but distinct classes of soils used by civil engineers? **(1 mark)**

c) Briefly discuss the **FOUR** field identification tests that are used to distinguish silt from clay. **(8 marks)**

d) Outline the factors that affect permeability of soils. **(8 marks)**

e) A saturated sample of undisturbed clay has a volume of 19.2cm^3 and weighs 32.5gm. After oven drying, the weight reduces to 20.2gm.. determine:
(i) Water content **(2 marks)**

(ii) Specific gravity **(3 marks)**

f) Briefly discuss the **TWO** forces that play a role in the structure of soils **(4 marks)**

SECTION B (Attempt any TWO questions)

Question Two

a) Define:
- **(i)** Porosity
- **(ii)** Void ratio
- **(iii)** Water content
- **(iv)** Degree of saturation **(8 marks)**

b) A moist sample of soil has a volume of 464cm^3 in its natural state and weighs 793gm. The dry weight is 735gm and has a specific gravity of 2.68. Determine:
- **(i)** Void ratio
- **(ii)** Porosity
- **(iii)** Water content and
- **(iv)** Degree of saturation **(8 marks)**

c) Briefly discuss the following grain shape properties.
- **(i)** Bulky
- **(ii)** Flaky **(4 marks)**

Question Three

a) State Stoke's Law. Outline the assumptions considered in applying stoke's law. **(5 marks)**

b) Particles of 5 different sizes are mixed in the proportions shown below and enough water added to make 1000cm^3 of the suspension. The temperature of the suspension is 20^{o}C.

Particle Size (mm)	Weight (g)
0.050	6
0.020	20
0.010	15
0.005	5
0.001	4
Total	50

$$\mu = 1.11\times10^{-5}\ g.s/cm^2$$

Take Gs = 2.70 w = 1g/cm^3, viscosity

- **(i)** What is the largest particle size at a depth of 6cm, 8mins after start of sedimentation? **(3 marks)**
- **(ii)** What is the Gs of the suspension at a depth of 6cm after 8 minutes of sedimentation **(5 marks)**
- **(iii)** How long should the sedimentation be allowed so that all the particles have settled below 6cms? **(4 marks)**

c) Define specific gravity (Gs) of a material. Distinguish this from unit weight (s) **(3 marks)**

Question Four

a) Specific gravity for a soil was obtained in a laboratory test. The following measurements were made W_s = 100g, W_1 = 608g, W_2 = 550g. By oversight, 2cm^3 of air remained entrapped in the suspension when the weight W_1 was taken.

(i) Will the value of Gs be lower or higher than the true value? **(5 marks)**
(ii) Calculate the percentage error **(3 marks)**

b) Briefly discuss Atterberg limite in soils **(8 marks)**

c) Define soil compaction. State the two main factors affecting soil compaction. **(4 marks)**

Question Five

a) Outline the assumptions considered when computing stresses at a point using Boussinesq's formula. **(4 marks)**

b) Three parallel strip footings 3m wide each and 5m apart centre to centre transmit contact pressures of 200, 150 and 100KN/m^2 respectively. Calculate the vertical stress due to the combined loads beneath the centres of each footing at a depth of 3m below the base. Assume the footings are placed at a depth of 2m below the ground surface. Use Boussinesq's equation for line loads. **(6 marks)**

c) Briefly discuss the effects of compaction on engineering behavior of soils. **(10 marks)**