TECHNICAL UNIVERSITY OF MOMBASA

Faculty of Engineering & Technology

DEPARTMENT OF BUILDING & CIVIL ENGINEERING

UNIVERSITY EXAMINATION FOR:
BACHELOR OF SCIENCE IN CIVIL ENGINEERING
(BSCE13S – Y3 S2)

ECE 2311: SOIL MECHANICS

END OF SEMESTER EXAMINATION
SERIES: APRIL 2014
TIME ALLOWED: 2 HOURS

Instructions to Candidates:
You should have the following for this examination
- *Answer booklet*
- *Scientific Calculator*

This paper consists of **FIVE** questions.
Answer question **ONE (COMPULSORY)** and any other **TWO** questions
All questions carry equal marks
Maximum marks for each part of a question are as shown
This paper consists of **THREE** printed pages

Question One (COMPULSORY)

a) Briefly discuss the assumptions considered when computing stresses at a point using Boussinesq's formula. **(5 marks)**

b) ABCD is a raft foundation of a multi-story building wherein AB = 20m and BC = 12m. The uniformly distributed load q over the raft is 1000KN/m^2. Determine δ_z at a depth of 6m below point O, wherein AA_1 = 4m and A_1O = 6m. Use chart II **(6 marks)**

C

Figure 1

c) Using illustrations, outline the factors that can cause instability in a slope and lead to failure. **(6 marks)**

d) Using Culman's method, determine the critical height of an embarkement having a slope angle of 40o and the constructed soil having C' = 630KN/m^2 $\phi' = 20^o$ and effective unit weight = 114kg/m^3. Find the allowable height of the embarkment if $Fc = F\phi = 1.25$ **(6 marks)**

e) Explain soil stabilization. Give three examples. **(7 marks)**

Question Two

a) Three parallel strip footings 3m wide and 5m apart centre to centre transmit pressure of 200, 150 and 100KNm^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 depth of 2m below the ground surface. Use Boussinesq's formula for line loads. **(6 marks)**

b) Outline the mohr- coulomb failure theory. **(4 marks)**

c) Briefly discuss the direct shear test of measuring shear strength. **(10 marks)**

Question Three

a) Outline the factors that affect mechanical stability of soils. **(5 marks)**

b) Briefly discuss the following categories of admixtures used in soil stabilization:

(i) Cementing materials
(ii) Modifiers
(iii) Water proofing agents
(iv) Water retaining and retarding agents **(10 marks)**

c) Compute the shearing strength of soil along a horizontal plane at a depth of 4m in a deposit of sand having the following properties; angle of internal friction $\phi = 35^o$; Dry unit weight d = 17KN/m^3, specific gravity Gs = 2.7

Assume the ground water table is at a depth of 2.5m from the ground surface. Also find the change in shear strength when the water table rises to the ground surface. **(5 marks)**

Question Four

a) Using illustrations, discuss the types of circular surfaces failure **(10 marks)**

b) Outline the THREE stages to the analysis of slope stability **(6 marks)**

c) Outline the shearing characteristics of a soil. **(4 marks)**

Question Five

a) Explain the following terms as applied in soil mechanics:
- **(i)** Angle of obliquity
- **(ii)** Principal plane
- **(iii)** Shear strength
- **(iv)** Cohesion

b) Compute the factor of safety of a slope of infinite extent having a slope of angle = 25°. The slope is made of cohesionless soil with $\phi = 30^o$. **(2 marks)**

Analyze the same slope if it is made of clay having C' = 30KN/m^2, $\phi_m = 20^o$, $e = 0.65$ and G_s = 2.7, under the following conditions:
- (i) When the soil is dry
- (ii) When water seeps parallel to the surface of slope
- (iii) When the slope is submerged **(8 marks)**

c) Outline the factors upon which cohesion (c) and normal stress (δ) depend when using Coulomb's equation. **(2 marks)**