TECHNICAL UNIVERSITY OF MOMBASA

FACULTY OF ENGINEERING AND TECHNOLOGY

DEPARTMENT BUILDING AND CIVIL ENGINEERING

UNIVERSITY EXAMINATION FOR:

BSC IN CIVIL ENGINEERING

ECE 2311: SOIL MECHANICS II

END OF SEMESTER EXAMINATION

SERIES: APRIL 2016

TIME: 2HOURS

DATE: 09May2016

Instructions to Candidates

You should have the following for this examination

-Answer Booklet, Drawing Instruments, Scientific calculator, examination pass and student ID

This paper consists of five questions. Attemptquestion ONE (Compulsory) and any other TWO questions.

Question One (Compulsory) (30marks)

a) The footings of sizes 4m x 4m and 3m x 3m are placed 9m centre to centre apart at the same level and carry loads of 250 kg and 220 kg respectively. Compute the vertical pressure at a depth of 5m at point C midway between the centers of the footings. **(8marks)**

b) Using illustrations, discuss the various causes of failure of slopes. **(10 marks)**

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

d) An unconfined cylindrical specimen of clay fails under an axial stress of 240 kN/m^2. The failure plane is inclined at an angle of 55^0 to the horizontal. Determine the shear strength parameters of the soil. **(6marks)**

e) Define shear strength of soil. **(2 marks)**

Question Two **(20marks)**

a) A concentrated load of 400kN acts at foundation level at a depth of 2m below ground surface. Compute the vertical stress along the axis of the load at a depth of 10m and at a distance of 5m at the same depth by (i) Boussinesq and (ii) Westergaard formulae for μ = 0. Neglect the depth of the foundation. **(8marks)**

b) With the aid of sketches, discuss the different types of circular surfaces failure. **(10marks)**

c) State the FOUR most important factors upon which c and σ, in Coulomb's equation depend **(2marks)**

Question Three **(20marks)**

a) Briefly describe the Direct Shear test for determining shear strength parameters of a soil. **(12 marks)**

b) Calculate the factor of safety against shear failure along the slip circle shown in the fig. below. Assume cohesion = 35kN/m^2, angle of internal friction = zero and total unit weight of the soil = 20kN/m^3. **(5marks)**

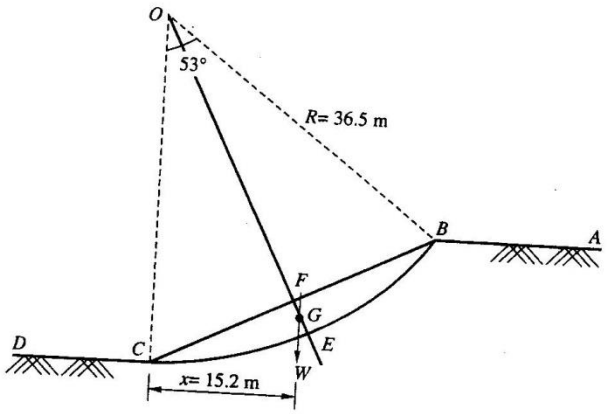

Fig. Ex. 16.6

c) Explain the assumptions used in Boussinesq's formula for point loads. **(3marks).**

Question Four **(20marks)**

a) Determine by Culmann's method the critical height of an embankment having a slope angle of 40° and the constructed soil having $C' = 650kN/m^2$, $Ø = 20°$ and effective unit weight = $120kN/m^3$. Find the allowable height of the embankment if $F_c = FØ = 1.25$ **(6 marks)**

b) What will be the factors of safety with respect to average shearing strength, cohesion and internal friction of a soil, for which the shear strength parameters obtained from the laboratory tests are $C' = 45kN/m^2$ and $Ø' = 18°$. The expected parameters of mobilized shearing resistance are $c_m' = 21kN/m^2$ and $Ø_u'$ and the average effective pressure on the failure plane is $120kN/m^2$. For the same value of mobilized shearing resistance, determine:

(i) Factor of safety with respect to height
(ii) Factor of safety with respect to friction when that with respect to cohesion is unity.
(iii) Factor of safety with respect to strength. **(10marks)**

c) Explain soil stabilization. **(4marks)**

Question Five **(20marks)**

a) Briefly describe the various types of admixtures used in soil stabilization. **(8 marks)**

b) Find the factor of safety of a slope of infinite extent having a slope angle of 25°. The slope is made of cohesion less soil with $Ø' = 30°$. **(2marks)**

c) Analyze the same slope if it is made of clay having $C' = 30kN/m^2$, $Ø' = 20°$, e = 0.65 and G = 2.7 under the following conditions:

i) When soil is dry
ii) When water seeps parallel to the surface of slope
iii) When slope is submerged **(10 marks)**