TECHNICAL UNIVERSITY OF MOMBASA.

FACULTY OF ENGINEERING AND TECHNOLOGY

DEPARTMENT OF BUILDING AND CIVIL ENGINEERING

UNIVERSITY EXAMINATION FOR

BACHELOR OF SCIENCE IN CIVIL ENGINEERING.

INSTITUTIONAL BASED PROGRAMME

ECE 2311: SOIL MECHANICS II

JULY 2017

Question One (Compulsory) (30marks)

a) Three parallel strip footings 3m wide each and 5m apart centre to centre transmit pressures of 200, 150 and 100kN/m^2 respectively. Calculate the vertical stress due to the combined loads beneath the centers of each footing at a depth of 4m below the base. Assume the footings are placed at a depth of 2m below the ground surface. **(9 marks)**

b) A concentrated load of 200kN 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 radial distance of 5m at the same depth by (i) Boussinesq's and (ii) Westergaard's formulae for $\mu = 0$. Neglect the depth of the foundation. **(8marks)**

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

d) Define shear strength of soil. **(3marks)**

Question Two (20marks)

a) An unconfined cylindrical specimen of clay fails under an axial stress of 240kN/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)**

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

c) 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 250kg and 220kg respectively. Compute the vertical pressure at a depth of 5m at point C midway between the centers of the footings. **(8marks)**

Question Three **(20marks)**

a) Describe the assumptions used in Boussinesq's formula for point loads. **(4marks).**

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

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

Question Four **(20marks)**

a) 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)**

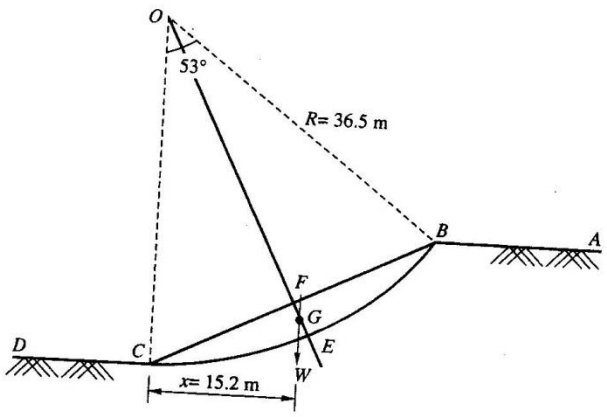

Fig. Ex. 16.6

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

c) Describe the FOUR most important factors upon which c and σ, in Coulomb's equation depend **(5marks)**

Question Five **(20marks)**

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

b) Compute 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)**