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) 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 and (ii) Westergaard formulae for $\mu = 0$. Neglect the depth of the foundation. **(8marks)**

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

c) ABCD is a raft foundation of a multi-storey building, wherein AB = 30m and BC = 12m. The uniformly distributed load q over the entire raft is 750KN/m^2. Determine σ_z at a depth of 20m below point O at the center of the raft. (Use chart II). **(5marks)**

d) i) Define a Rotational slide.(Illustrate) **(4marks)**

Ii) Using illustrations outline the different types of circular surfaces failure. **(9marks)**

Question Two **(20marks)**

a) Three parallel strip footings 3m wide each and 5m apart centre to centre transmit pressures of 250, 200 and 150kN/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.

(10 marks)

b.) With the aid of sketches, discuss the various causes of failure of slopes. **(10 marks)**

Question Three **(20marks)**

a) Briefly describe the Triaxial compression test for determining shear strength parameters of a soil. **(13 marks)**

b) In Coulomb's equation, c and σ depend upon many factors. State the FOUR most important factors. **(2marks)**

c) Calculate the factor of safety against shear failure along the slip circle shown in the fig. 16.6. Assume cohesion = 40kN/m^2, angle of internal friction = zero and total unit weight of the soil = 20kN/m^3. **(5marks)**

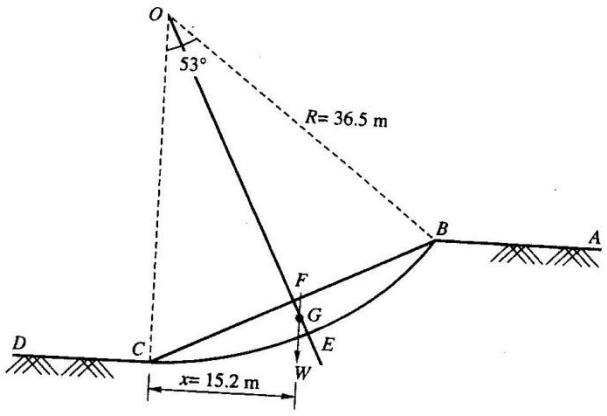

Fig. Ex. 16.6

Question Four **(20marks)**

a) i) What is soil stabilization? **(2marks)**

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

b) 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 200kg and 180kg respectively. Compare the vertical pressure at a depth of 4m at point C midway between the centers of the footings. **(8marks)**

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

Question Five **(20marks)**

a) An unconfined cylindrical specimen of clay fails under an axial stress of 240KN/m^2. The failure plane was inclined at an angle of 55° to the horizontal. Determine the shear strength parameters of the soil. **(5 marks)**

b) 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 **(5 marks)**

c) What are 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' = 32kN/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 110kN/m2. 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.

(10 marks)

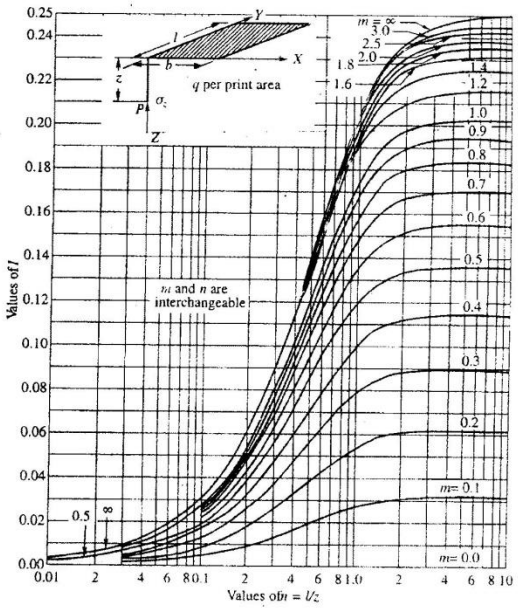

Fig. 10.9 Graph for determining influence value for vertical normal stress σ_z at point ρ located beneath one corner of a uniformly loaded rectangular area. (After Fadum)