TECHNICAL UNIVERSITY OF MOMBASA

FACULTY OF ENGINEERING AND TECHNOLOGY
DEPARTMENT OF BUILDING & CIVIL ENGINEERING
UNIVERSITY EXAMINATION FOR:
INSTITUTION BASED PROGRAMME

BACHELOR OF SCIENCE IN CIVIL ENGINEERING
ECE 2311: SOIL MECHANICS II

END OF SEMESTER EXAMINATION
SERIES: AUGUST 2017
TIME: 2 HOURS

Instructions to Candidates

You should have the following for this examination
-Answer Booklet, examination pass and student ID
This paper consists of five questions.
Attempt question ONE (Compulsory) and any other TWO questions.
Do not write on the question paper.

QUESTION ONE (COMPULSORY) 30 marks

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's and (ii) Westergaard's formulae for $\mu = 0$. Neglect the depth of the foundation. (8marks)
b) Using illustrations discuss the different types of circular surfaces of failure. (9marks)
c) ABCD is a raft foundation of a multi-storey building, wherein AB = 20m and BC = 12m. The uniformly distributed load q over the entire raft is 450KN/m^2. Determine σ_z at a depth of 6m below point O, wherein AA_1=4m and A_1O=6m. (Use chart II). (5marks)
d) Outline the shearing characteristics of a soil. (4marks)
e) Using illustrations describe a Rotational slide. (4marks)

ANSWER ANY TWO QUESTIONS FROM THIS SECTION
QUESTION TWO (20 marks)

a) Compute 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$_u$′= 13° and the average effective pressure on the failure plane is 110kN/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. (10 marks)

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

QUESTION THREE (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.
(9 marks)

b) 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)

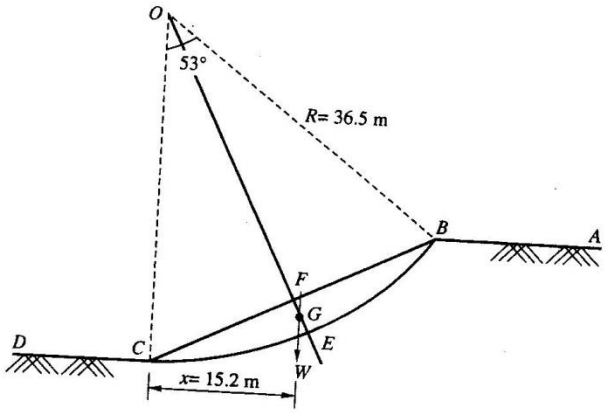

Fig. Ex. 16.6

c) In Coulomb's equation, c and σ depend upon many factors. Outline the FOUR most important factors. (4marks)

d) Define soil stabilization? (2marks)

QUESTION FOUR (20marks)

a) Briefly highlight 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 (6 marks)

c) Define" Shear Strength" of soil. (4marks)

QUESTION FIVE (20marks)

a) Briefly describe the Direct Shear box test for determining shear strength parameters of a soil. (10 marks)

b) Determine by Cullman's method the critical height of an embankment having a slope angle of 40° and the constructed soil having C' = 630kN/m^2 , Ø= 20° and effective unit weight = 114kN/m^3 . Find the allowable height of the embankment if F_c = FØ = 1.25 (6marks)

c) Outline the assumptions used in Boussinesq's formula for point loads. (4marks).

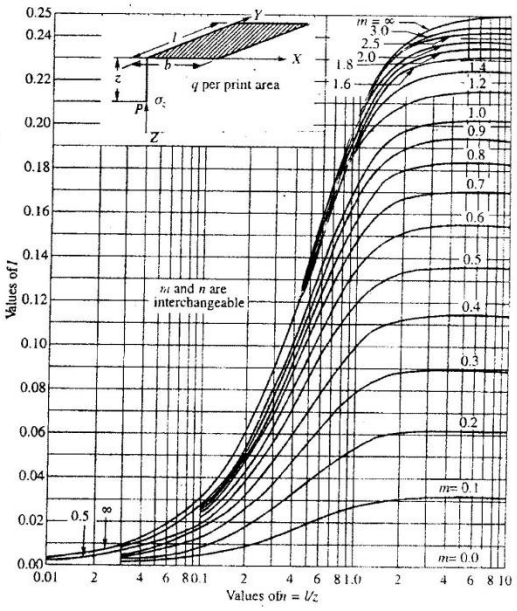

Fig. 10.9 Graph for determining influence value for vertical normal stress σ_z at point P located beneath one corner of a uniformly loaded rectangular area. (After Fadum)