TECHNICAL UNIVERSITY OF MOMBASA

Faculty of Engineering & Technology

DEPARTMENT OF BUILDING & CIVIL ENGINEERING

DIPLOMA IN BUILDING & CIVIL ENGINEERING (DBCE 12M)

EBC 2206: SOIL MECHANICS II

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

Instructions to Candidates:
You should have the following for this examination

- *Answer booklet*
- *Drawing Paper*
- *Drawing Instruments*

This paper consists of **FIVE** questions. Answer any **THREE** questions of the **FIVE** questions
All questions carry equal marks
Maximum marks for each part of a question are as shown
This paper consists of **FOUR** printed pages

Question One

a) (i) Explain TWO main types of slopes giving TWO examples of each.
(ii) State TWO considerations that are made in the analysis of slope stability.
(iii) Outline the concept of slope failure. **(8 marks)**

b) A cutting in a saturated clay is inclined at a slope of 1-vertical: 1.5-horizontal and has a vertical height of 10m. The bulk unit weight of the soil is 18.5KN/m^3 and its undrained cohesion is 40KN/m^3. $(\beta u = 0)$

4.32m

$\theta = 84.06^o$

Sector angle

$\theta_c = 67.44^o$

Sector angle
Area of slip mass, A = 77.35m^2
Area of slip mass, B = 71.64m^2

Ignoring tension crack, centroid distance = 6.50m
Allowing for tension crake, centroid distance, d = 5.86m

Determine the factor of safety against immediate shear failure along the slip circle shown in the figure:
(i) Ignoring the tension crack
(ii) Allowing for the tension crack empty of water
(iii) Allowing for the tension crack when full of water. **(12 marks)**

Question Two

a) Explain the terms:
   (i) Disturbing moment
   (ii) Resisting moment
   (iii) Factor of safety against slip **(6 marks)**

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b) The bank of a canal has the profile as shown in the figure above. The material is homogenous clay of density 2000kg/m^3, cohesion = 30km/m^2 and angle of shearing resistance zero. For the trial slip circle shown, the area ABCDE is 151m^2 and the centroid is at G. Determine for each of the following conditions the factor of safety for this slip circle.
   (i) If the water in the canal is level with the top of the bank
   (ii) If the canal is empty
   In both cases allow for a tension crack 3m deep which may be filled with water.
   (10 marks)

c) Explain elastic and plastic equilibrium. **(4 marks)**

Question Three

a) (i) Define shear strength. **(4 marks)**

(ii) Outline the importance of studying shear strength. **(3 marks)**

b) Outline the shear strength parameters. **(6 marks)**

c) Briefly describe the shear box test. **(7 marks)**

Question Four

a) With the aid of a sketch, describe rotational slip as applied in slope failure. **(5 marks)**

b) The slope of a water retaining embankment is 1-vertical; 2-horizontal and the vertical height is 10m. The soil is fully saturated and has an undrained cohesion of 30KN/m^2 and a unit weight of 18KN/m^3. Determine the factor of safety against shear failure along the trial step circle shown in the figure below:

(i) When the water level is 6m above the toe.

A

(ii) When water level is at the toe of the slope

For zone A(FBDE), Area $A_A = 41.2m^2$

(Centroid distance, $d_A = 13.0m$

For zone B, (EDA) Area $A_B = 144.11m^2$

Centroid distance $d_B = 4.44m$

$\theta = 76.06^o$

Sector angle **(15 marks)**

Question Five

a) Define the following:

(i) Ultimate bearing capacity

(ii) Net ultimate bearing capacity

(iii) Allowable bearing capacity
(iv) Safe bearing capacity **(8 marks)**

b) Outline the factors affecting bearing capacities. **(12 marks)**