BACHELOR OF SCIENCE IN CIVIL AND STRUCTURAL ENGINEERING DEGREE

FIRST SEMESTER EXAMINATIONS 2013/14 ACADEMIC YEAR

COURSE CODE: CSE 321

COURSE TITLE: SOIL MECHANICS

<u>**Instructions to Candidates**</u>

    (ii) Cartesian graph paper to be provided to each student

    (iii)Answer Question 1 and any three questions

    (iv)**Duration**: Time: 3hrs

Question 1 (40 marks)

(a) A soil sample in a triaxial test is subject to a major and minor principal stresses of 300kPa and 100kPa respectively. Draw the Mohr circle of stresses on a plane inclined at 35^0 with major principal plane and obtain the shear strength parameters for this plane.

  If during the triaxial test pore water measurement was carried out and a reading of   10kPa was obtained. What is the effective values of shear strength parameters   (20 marks)

(b) The sand in a deep deposit has an angle of internal friction of $\emptyset = 35^0$ and a dry unit weight γ =19kN/m^3 and saturated unit weight of 21kN/m$^{3.}$ If the water table is at a depth of 1.5m from ground level, what is the shearing resistance of the soil to sliding along a horizontal plane at a depth of 3m from ground level? Assume the sand to be dry above the water table. (10marks)

(c) (i) Explain the triaxial method that is used to determine shear strength parameters (5 Marks)

    (ii)   Discuss the shortcomings of shear box test (5 marks)

Question 2 (20 marks)

A stable underground wall is subjected to at-rest lateral pressure and water pressure. The total depth of the underground wall is 8m and water table is 4m below ground surface.
(a) Plot at-rest lateral earth pressure and water distribution against the wall (10 marks)
(b) Calculate the resultant force against the wall and its point of application. The soils properties are as follows
$\emptyset$'=38^0 and γ_t=19.5kN/m^3

(10 marks)

Question No.3 (20 marks)

(a) Derive the equation for lateral earth pressure for the at rest condition,

$\sigma_{h = Ko\gamma z}$ (5 marks)

(b) What are different materials used for sheet pile walls?

explain the advantages of some sheet materials over others

(5 marks)

(c) Find the factor of safety for a retaining wall with the following specifications: Height of retaining wall is 10m,weight of retaining wall is 2300kN per metre run and weight acts at a distance of 5m from the Toe. The friction angle of the soil backfill is 30^0 .The backfill consist mainly of sandy soils. The density of the soil is $17.3kN/m^3$. The friction angle between the soil and earth at the bottom of the retaining wall is 20^0 (10 marks)

Question 4 (20 marks)

(a)   Give five causes that may lead to failure of slopes. Discuss how each of these causes may lead to slope failure (10 marks)

(b)   What are the general considerations and assumptions in the analysis of slopes.? With the help of diagrams discuss the failure mechanism of earth slopes with respect to earth dams (10 marks)

Question 5 (20 marks)

Determine 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 laboratory tests are $c'=27kN/m^2$ and $\emptyset'=15$; the expected parameters of mobilized shearing resistance are $c'_m=18kN/m^2$ and $\emptyset'_m=12^0$ and the average effective pressure on the failure plane is $103kN/m^2$. For the same value of mobilized shearing resistance determine the following:

(i) Factor of safety with respect to height (6 marks)

(ii) Factor of safety with respect to friction when that with respect to cohesion is unity (8 marks)

(iii)Factor of safety with respect to strength (6marks)