FIRST SEMESTER EXAMINATIONS 2013/2014 ACADEMIC YEAR

Bachelor of Science in Civil and Structural Engineering Degree

Course Code and Title: CSE 222 SOIL MECHANICS I

Instructions to Candidates

Answer Question 1 and any three questions

Duration: Time: 3hrs

Question 1 (31 marks)

(a) A sample of saturated clay from a consolidometer test has a total mass of 1.526kN and a dry mass of 1.053kN: the specific gravity of solid particles is 2.7. For this sample determine

(i) Water content (4marks)

(ii) Void ratio (4marks)

(iii) Porosity (4marks)

(iv) Total density (4marks)

(Total Marks 16)

(b) A soil sample in its natural state has, when fully saturated, a water content of 30.5% .Assume Gs=2.69 Determine

(i) The void ratio (3 marks)

(ii) Dry unit weight (3 marks)

(iii) Total unit weight (4 marks)

(iv) Calculate the total weight of water required to saturate a soil

Mass of volume $10m^3$ (5 marks)

(Total 15 marks)

Question 2 (23 marks)

A sand sample of 35cm^2 cross-sectional area and 20 cm long was tested in a constant head permeameter. Under a head of 60cm, the discharge was 120ml in 6 min. The dry weight of sand used for the test was 1120g, and G=2.68. Determine

(a) Coefficient of permeability in cm/s (10 marks)
(b) Discharge Velocity (10 marks)
(c) The seepage Velocity (3 marks)

(Total 23 marks)

Question No.3 (23 marks)

(a) What is soil mechanics? (6 marks)

(b) Why do we as civil engineers study soil mechanics? (10 marks)

© Name and discuss the principal minerals of clay soil (7 marks)

Question 4 (23 marks)

(i) What are soil index properties (6 marks)

(ii) A sample of clay has a liquid limit of 62%,and its plasticity index is 32%

(a) What is the state of Consistency of the soil if the soil in its natural state has a water content of 34%? (7 marks)

(b) Calculate the shrinkage limit if the void ratio of the sample at the shrinkage limit is 0.70. Assume G=2.70 (10 marks)

Question 5 (23 marks)

A stratum of normally consolidated clay 7m thick is located at a depth of 12m below ground level. The natural moisture content of the clay is 43% and its liquid limit is 48%. The specific gravity of the soil particles is 2.76.The water table is located at a depth of 5m below ground surface. The soil is sand above the clay stratum. The submerged unit weight of the sand is 11kN/m^3 and the same weighs 18kN/m^3 above the water table . The average increase in pressure at the centre of the clay stratum is 120kN/m^2 due to the weight of a building that will be constructed on the sand above the clay stratum. Estimate the expected settlement of the structure (23 marks)