Roll No. | | | | | | | | | | | | | **Total No. of Pages : 02**

Total No. of Questions : 08

M.Tech.(Geo Technical Engineering)/(Soil mechanics & foundation engineering) (2013 & Onwards) (Sem.–1)

ANALYSIS OF SETTLEMENTS OF SOIL AND FOUNDATION

Subject Code : CESE-5

M.Code : 37213

Time : 3 Hrs. **Max. Marks : 100**

INSTRUCTIONS TO CANDIDATES :

1. **Attempt any FIVE questions out of EIGHT questions.**
2. **Each question carries TWENTY marks.**

1. (a) With help of stress-strain diagram, distinguish between following for soils.

   (i) Peak and Residual strength.

   (ii) Initial tangent modulus and secant modulus. (12)

   (b) Define Stress Path. Draw the stress path for stress changes in tri- axial test and the corresponding field applications. (8)

2. (a) List various assumptions made in Tergahi's three dimensional consolidation equation. Also derive the equation. (12)

   (b) An embankment is proposed to be constructed over clay 6m thick, underlain by an imperable stratum. The embankment is 4m high and the fill soil has a unit weight of 18kN/m^3. The clay has the following properties C_h = 8$m^{2/}$year and C_v = 6.5 $m^{2/}$year, $m_v = 2.6 \times 10^{-4}$ m^2/kN. Sand drains of 250mm dia are proposed to be installed in a square pattern, at a spacing of 2m c/c. Determine the magnitude of settlement that can be expected due to consolidation of clay layer after 12 months of effective embankment loading. (8)

3. An embankment of 10 m height is to be constructed on 8 m thick layer of clay overlying rock. The embankment will increase the mean effective vertical stress in the clay after consolidation from 80 kN/m^2 to 200 kN/m^2. The embankment will carry a road which will be laid in 5 months. The surface will be laid 13 months after the commencement of construction. Assuming that settlement to the extent of 30 mm is allowed after the surfacing of the road, comment on the design of 300 mm diameter sand drains spaced at 2.2 m centre to centre. The sand drains may be arranged in a square pattern. Take coefficient of consolidation in direction = coefficient of consolidation in radial direction Assume coefficient of volume change = 0.3 m^2MN.

   (for T_R = 0.36 and n = 8.26, u for radial flow = 88%) (20)

4. (a) Explain the salient points in the strength behaviour of saturated cohesive soils under undrained test conditions. (10)

   (b) A soil specimen having C = 86 kN/ m^2 and $\phi = 30°$ is tested in a tri-axial apparatus. Estimate. (10)

   (i) The deviatoric stress at failure when the cell pressure is 60 kN/ m^2

   (ii) The cell pressure if major principal stress is 900 kN/ m^2

5. (a) How do you calculate safe load capacity of piles by static formula under different solid conditions? (10)

   (b) Design a friction pile group to carry a load of 3000 KN including the weight of pile cap at a site where soil is uniform clay to a depth of 20m, underlain by rock. Average unconfined compressive strength of the clay is 70 KN/ m^2. The clay is of normal sensitivity and its liquid limit is 60%. A factor of safety of three is required against shear failure. (10)

6. (a) Explain Schmartmann's method of extrapolating field consolidation curves from lab consolidation curves. (10)

   (b) A clay layer, 5m thick, is consolidated with the help of drain well of diameter 30cm and spaced at 2.7 meters arranged in square pattern. Determine the influence of the wells on average degree of consolidation at the time when the degree of consolidation in the clay without wells would be equal to 20 percent. Assume permeability of soil in all the direction equal. (10)

7. The following data refers to a pile load test carried on a 300mm dia pile in a sandy strata :

Load (kN)	50	100	200	300	400	500	600
Settlement (mm)	2.5	4	9.5	16.5	27	40.5	61

   Draw the load settlement curve. Also find out the settlement corresponding to load of 160kN. If these piles are used in 16 Number pile group having c/c spacing of 900mm, calculate the settlement of pile group. (20)

8. Write short notes on following :

   (a) Under-reamed pile foundation (7)

   (b) Limitations of dynamic formula for pile load capacity (6)

   (c) Shear modulus for soils. (7)

NOTE : Disclosure of Identity by writing Mobile No. or Making of passing request on any page of Answer Sheet will lead to UMC against the Student.