Ref. No. EX/CON/T/426A/2017 (Old)

B. E. CONSTRUCTION ENGINEERING 4TH YEAR 2ND SEMESTER - 2017

Subject: Advanced Foundation Technique

Time : Three Hours

Answer Q.No.5 and any THREE from the rest

Full Marks : 100

1. (a) What do you mean by soil stabilization? Write a short note on soil stabilization with lime and cement.

   (b) A permanent surcharge of 100 kN/m^2 is to be applied on the ground surface of the soil profile shown in Fig.1. It is recommended to eliminate all of the primary consolidation in 3 months. Estimate the total surcharge $\sigma = \sigma_s + \sigma_f$ needed to achieve the goal. Fig.2 and Fig.3 may also be used, if required.

   10 +15

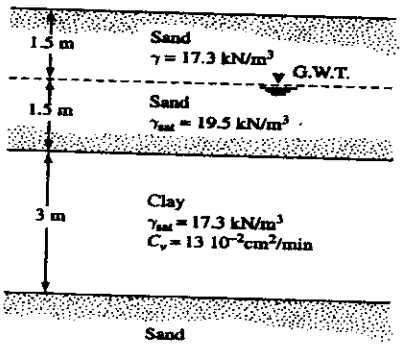

Figure : 1

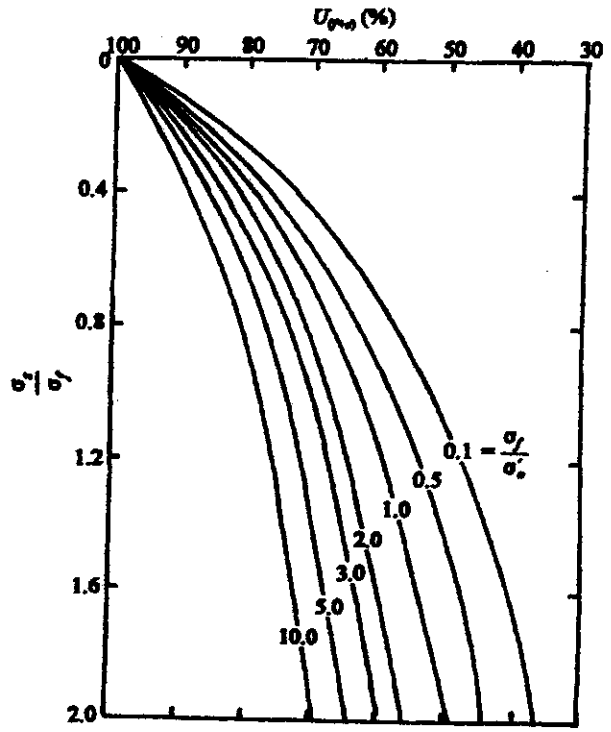

Figure : 2

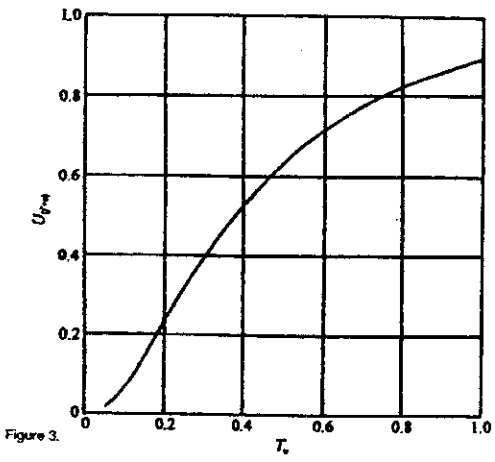

Figure 3.

2. (a) Write down the equation for radial drainage obtained from Terzaghi's consolidation theory stating clearly the meaning of the various notations.

(b) Explain the basic theory behind the working principles of band drains. Enumerate its design criterion.

(c) What do you mean by equal strain theory?

(d) A 6m thick clay layer drained at top and bottom has some sand drains. A uniform surcharge is applied at the top of the clay layer. Calculate the average degree of consolidation for combined vertical and radial drainage after 100 days of load application. Given $C_{vr} = C_v = 4$ mm^2/min, $d_e = 2$m, and $r_w = 0.2$m. Assume no smear. 3+5+2+15

3. (a) State and explain the basic theory behind the improvement of shear strength by using geotextile. Name the scientist who first proposed the use of geotextile for soil.

(b) How many different kinds of geotextiles are manufactured depending upon the direction of the load transfer? What is geogrid? Mention the various uses of geotextiles giving neat sketches.

(c) For the 6.4 m high, 40^0 angle slope shown below in Fig.4, consists of a silty clay deposit ($\varphi = 0^0$, $\gamma = 20.02$ kN/m^3, c = 14.60 kPa, area = 23.22m^2) on a silty clay foundation ($\varphi = 0^0$, $\gamma = 20.02$ kN/m^3, c = 14.60 kPa, area = 23.22m^2). Determine (a) the factor of safety with no geotextile reinforcement, (b) the factor of safety with a geotextile reinforcement of allowable tensile strength of 22.3 kN/m placed along the surface between the foundation soil and embankment soil, (c) the factor of safety with seven layers of the same geotextile placed at 0.9m interval from the interface of the top of the embankment. Assume that sufficient anchorage behind the slip circle shown is available to mobilize full geotextile strength. 6 + 7 +12

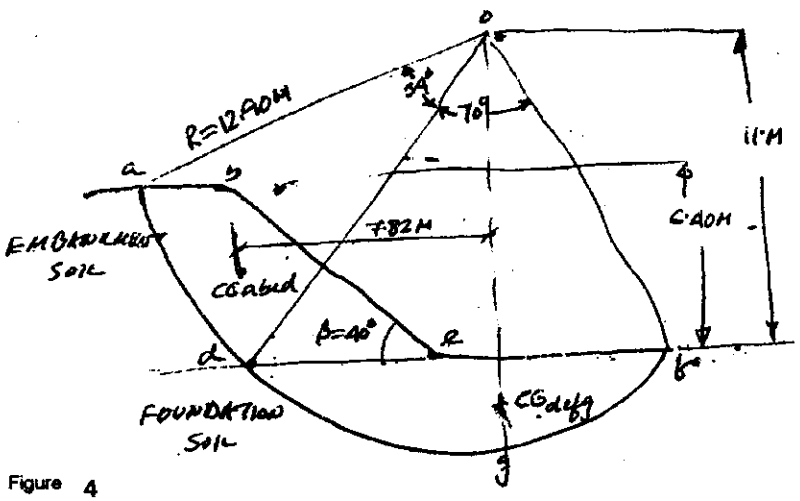

Figure 4

4. (a) State and explain stress path giving a neat sketch. Draw the stress paths for K_0 line, K>1 line and K = 1 line.

(b) Express the shear strength parameters (c, φ) in terms of the intercept (a) and slope (α) of K_f- line in the p-q diagram. Deduce the necessary relationship.

(c) CU triaxial tests with pore pressure measurements conducted on specimens of a saturated clay soil gave the following results:

Cell Pressure σ_3 (kN/m^2)	Additional axial stress ($\sigma_1 - \sigma_3$) ot deviator stress at failure (kN/m^2)	Pore water pressure u at failure (kN/m^2)
150	102	80
300	200	164
450	304	264
600	405	325

Determine the effective stress strength parameters c' and φ' by the Mohr circle method and the stress point method. 5 + 5 +15

5. Write short notes on the following: 5 x 5

(i) Ground improvement with stone columns

(ii) Foundations on expansive soils

(iii) Grouting in alluvial soil

(iv) Meaning of the basic assumptions of soil mechanics

(v) Effective stress path for CU test of normally consolidated clay.