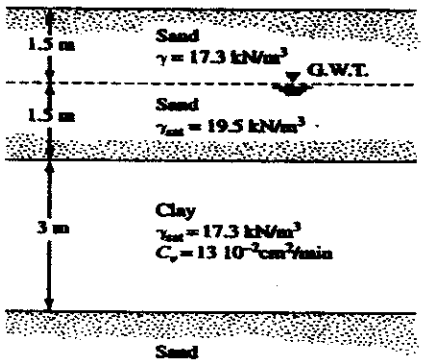
BE Constn. Engg. Fourth Year Second Semester Examination – 2018

Subject: **Advanced Foundation Technique**

Time : Three hours **Full Marks: 100**

Different parts of the same question should be answered together.

CO1 [25]	Answer any one from **(a) and (b) in this block** [1] (a) (i) Write a short note on use of preloads in applications involving precompression. (ii)A permanent surcharge of 150 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.  Figure : 1

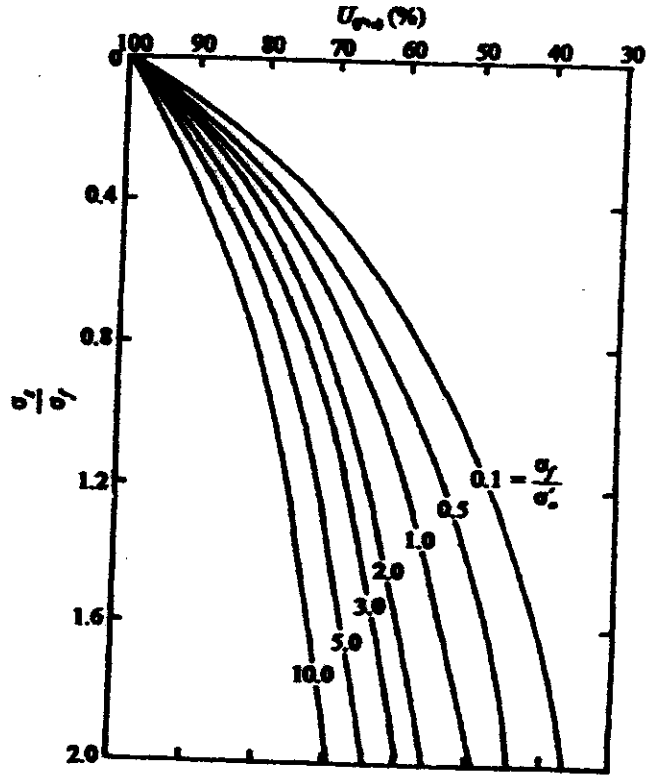


Figure : 2

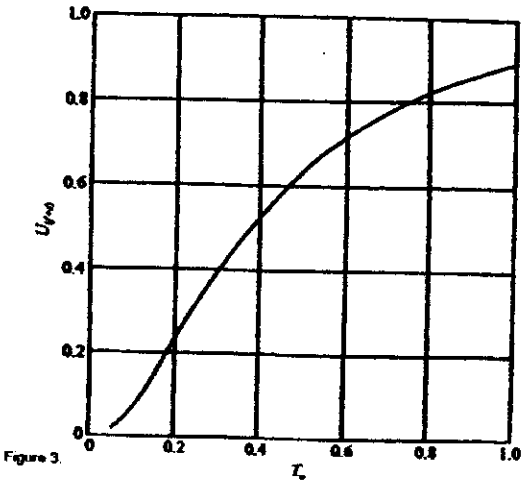


Figure 3.

[10 +15]

(b) (i) Deduce the expression for combined degree of consolidation due to foundation loading and surcharge.
(ii) A 25cm total consolidation settlement of the two clay layers shown in Fig. is expected owing to the application of the uniform surcharge q. Find the duration after the load application at which 12.5cm of total settlement would take place. [10 +15]

CO2 [15]

[2] *Answer any* **one(1) from (a) and (b)** *in this block*

(a) What do you mean by soil stabilization? Write a note on different soil stabilization techniques.[5+10]
(b) What are expansive soils? Which regions are they mostly found in? Write down the different methods used for rectifying the problems. [5+5 +5]

CO3 [30]

Answer any **two(2) from (a) and (b)** *in this block:*

[3] (a) (i) Write down the equation for radial drainage obtained from Terzaghi's consolidation theory stating clearly the meaning of the various notations. State its difference from one dimensional consolidation theory.

(ii) A 6m thick clay layer is drained at top and bottom and has some sand drains. The given data are C_v (for vertical drainage) = 49.51 x 10^{-4} m^2/day; k_v=k_h; d_w=0.45m; d_e=3m; r_w=r_s (i.e., no smear).

It has been estimated that a given uniform surcharge would cause a total consolidation settlement of 300mm without the sand drains. Calculate the consolidation settlement of the clay layer with the same surcharge and sand drains at time 2.4 , 7.2 and 12 months. [10+20]

(b) (i) State the design guidelines for stone columns.

(ii) A stone column foundation work is proposed to be conducted for ground improvement work near Haldia for supporting storage tanks of 50m diameter and height 12m. Suggest a suitable scheme for stone column foundation. The subsoil consists of 8m thick silty clay layer with decomposed wood layer (C_u = 2.5 t/m^2 , γ_t = 1.75 t/m^3 & m_v = 0.0642 cm^2/kg) sandwiched between a top dessicated layer (C_u = 3.5 t/m^2 , γ_t = 1.80 t/m^3, m_v = 0.0451cm^2/kg) and bottom stiff layer. The top dessicated layer extends upto 2m below ground level. The ground water table exists at 2m below ground level. The storage tank will be water tested to its full depth and will be placed on 1m thick sand layer. Show checks against bearing capacity failure and settlement. Assume any suitable data necessary. [10+20]

CO4 [30]

Answer any **one(1) from (a) and (b)** *in this block:*

[4] (a) (i) What is meant by mechanically reinforced earth walls? Explain with neat sketches giving its salient features.

(ii) Discuss the several factors that influence the design of a reinforced earth wall.

(iii) Analyze the wall of Fig. 4 for using strip reinforcement. The strips will be spaced at s = 1 m and h = 1 m to centre on the concrete wall facing units. Interlocking reinforced concrete facing units which are shaped as indicated. A wall footing will be poured to provide alignment and to spread the facing unit load somewhat since their weight is more than the unit weight of the soil. A 150 mm thick reinforced cap will be placed on top of the wall to maintain top alignment and appearance. Assume height of the wall to be 9 m. Analyze a typical interior vertical section and select tension strips based on f_a = 140 MPa (strip metal), $\varphi = 34^0$, γ = 17.30 kN/m^3, and $\delta = 24^0$. Also check against sliding.

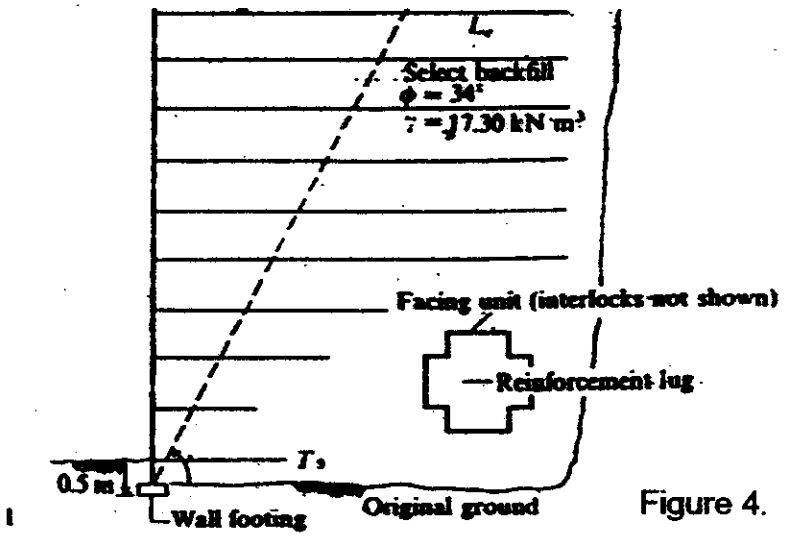


Figure 4.

[10+5+15

(b) (i) What are geotextiles? Write a brief note on their various uses. How do you determin factor of safety for slope stability using geotextiles?

(ii) How many different kinds of geotextiles are manufactured depending upo direction of the load transfer?

(iii) For the 6.4 m high, 40^0 angle slope shown below in Fig.5, consisting of a silty embankment ($\varphi = 0^0$, $\gamma = 19.22$ kN/m^3, c = 9.7 kPa, area = 27.03m^2) on a silty clay found ($\varphi = 0^0$, $\gamma = 20.02$ kN/m^3, c = 15.0 kPa, area = 23.22m^2). Determine (a) the factor of s with no geotextile reinforcement, (b) the factor of safety with a geotextile reinforceme allowable tensile strength of 24 kN/m placed along the surface between the foundation so embankment soil, (c) the factor of safety with eight layers of the same geotextile plac 0.8m interval from the interface of the top of the embankment. Assume that suff anchorage behind the slip circle shown is available to mobilize full geotextile strength.

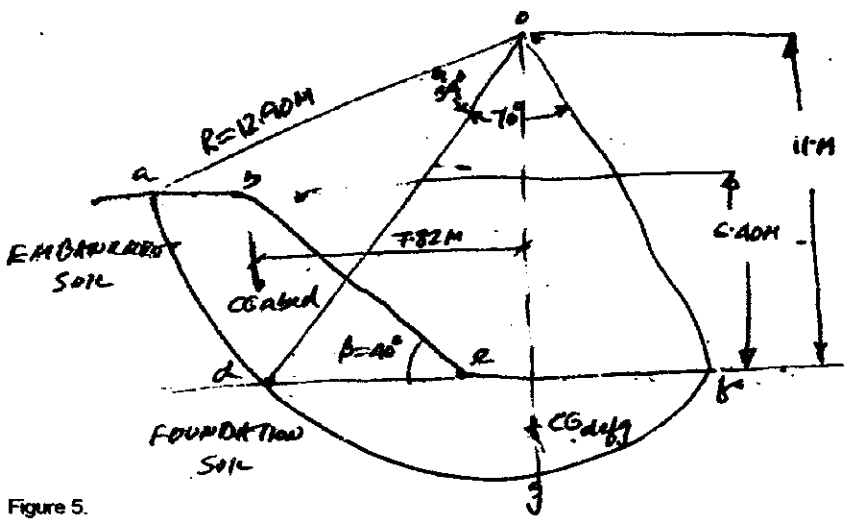


Figure 5.

[10 + 5 +15]

CO1: Solve problems related to precompression and preloading and interpret the theories **(K2)**
CO2: Describe different soil stabilization methods, foundations in difficult ground, foundations of expansive soil and Vibroflolation technique **(K2)**
CO3: Analyse problems related to design of sand drains and stone columns and illustrate the theories **(K4)**
CO4: Demonstrate ability of geosynthetics based designs and relate their application **(K3)**

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