Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

M.E –IIst SEMESTER–EXAMINATION – JULY- 2012

Subject code: 1722005 **Date: 10/07/2012**

Subject Name: Advanced Foundation Engineering

Time: 10:30 am – 13:00 pm **Total Marks: 70**

Instructions:

1. **Attempt all questions.**
2. **Make suitable assumptions wherever necessary.**
3. **Figures to the right indicate full marks.**

Q.1 **(a)** With suitable sketches explain the various ground improvement techniques. **07**

(b) Briefly explain all important location & depth criteria for the shallow foundations. **07**

Q.2 **(a)** State different types of piles and briefly explain 'Pile Load Test'. **07**

(b) A 4 x 4 = 16 pile group is embedded in uniform cohesive bed **07**
(Cu = 70 kPa, $\Phi u = 0.0^\circ$, γ_t = 18 kN/m^3, G = 2.70, γd = 15.5 kN/m^3, LL= 70 %). The piles diameter and length are 0.60 m and 15.0 m respectively. Calculate the settlement of the pile group under the applied load of 3000 kN.

OR

(b) Find the ultimate load carrying capacity of the above pile group. Consider $\alpha = 0.7$ **07**

Q.3 **(a)** State important factors affecting bearing capacity of a soil. **07**
For the data given below, compute the safe bearing capacity values for a 1.50 m x 2.00 m size rectangular footing placed at 1.50m depth below the ground level. :-

- GWT = 2.00 m below the GL
- Soil properties : γ_t = 16 kN/m^3 ; γ_{sat} = 18.5 kN/m^3 ; C = 33 kPa , $\Phi = 26^\circ$

Φ°	Nc	Nq	Nr
16	12.9	4.4	2.5
18	16.7	6.1	4.8
20	17.7	7.4	5.0
26	25.8	13.1	10.5

(b) Mention the different factors which may cause settlements of a structure. A 2.00 m x 3.00 m size footing is placed at 2.00 m depth below the ground level (GL) within a 10.0 m thick clay stratum. Ground water table (GWT) lies at 2.00 m depth below the GL. The clayey soil has γ_t = 18.0 kN/m^3, γ_{sat} = 21.00 kN/m^3, LL = 70%, G = 2.7 & water content below 2.0m depth = 20.19 %. If the gross pressure intensity at the footing base = 250 kPa, divide the clay stratum in TWO PARTS and compute the settlement due to consolidation (Sc). **07**

OR

Q.3 **(a)** Briefly explain the 'Standard Penetration Test'. How it is useful for computing safe bearing capacity and settlement of a shallow foundation? **07**

(b) To the total calculated settlement value, which corrections shall be applied? Why? For the data given in Q.3(b) above, compute elastic settlement of the footing if E = 2500 kN/m^2 , $\mu = 0.5$ & $I_f = 1.10$. **07**

Q.4 **(a)** Mention about different types of 'Geosynthetics' and in context of Foundation related problems, explain various applications of geosynthetics. **07**

(b) Determine the natural frequency of a machine foundation which has a base area of 2.50m x 2.50m and weight of 180 kN including the weight of the machine. Take the value of the coefficient of elastic uniform compression as 5.1 x 10^4 kN/m^3. **07**

OR

Q.4 **(a)** What do you mean by 'Reinforced Earth'? Explain various modes of failure for **07**

Reinforced Earth Bed with suitable sketches.

(b) The exciting force in a constant force amplitude excitation is 80 kN. The natural frequency of the machine foundation is 3.8 Hz. The damping factor is 0.28. Determine the magnification factor at an operating frequency of 5 Hz. **07**

Q.5 **(a)** In which circumstances the 'Combined Footings like rectangular, trapezoidal & cantilever' will be required? Also state requirements for 'RAFT' footing and compare all these footings. **07**

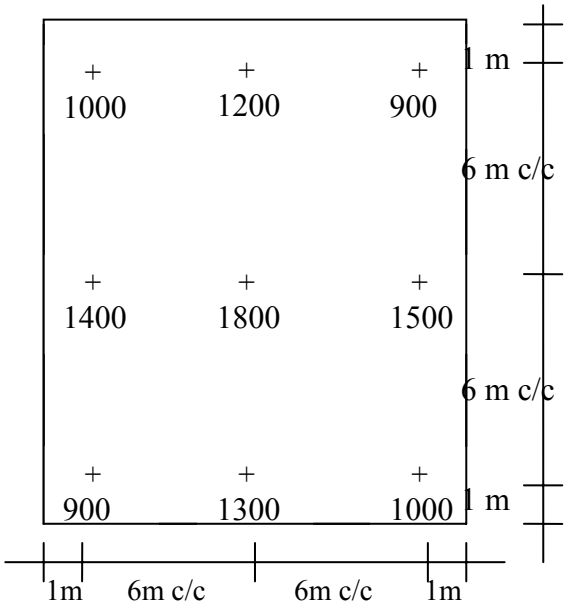
(b) For the data given below, find size of the TRAPEZOIDAL combined footing and draw only S.F. diagram mentioning typical values:- **07**

1. LHS column: 0.50m x 0.50m touching the property line on LHS.
   W1 = 2000kN
2. RHS column: W2 = 1500 kN
3. c/c distance between column axes = 7.50 m
4. SBC = 140 kPa

OR

Q.5 **(a)** For the data given above consider SBC = 280 kPa and find size of the STRAP footing and draw S.F. & B.M. diagrams mentioning typical values. **07**

(b) For a raft shown below, compute the contact pressures under the corner points. If SBC = 80 kPa, give comments on the results. Loads are in kN. (Fig. is not to the scale). **07**



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