Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

M. E. - SEMESTER – II • EXAMINATION – SUMMER • 2013

Subject code: 1722005 **Date: 03-06-2013**

Subject Name: Advanced Foundation Engineering

Time: 10.30 am – 01.00 pm **Total Marks: 70**

Instructions:

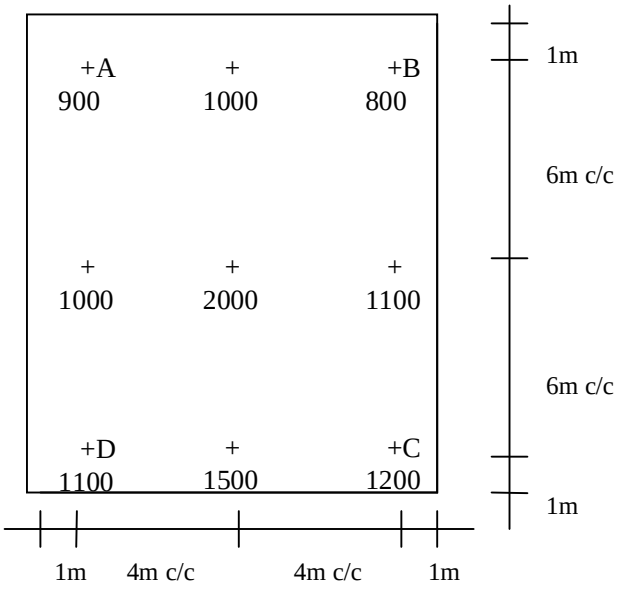
1. **Attempt all questions.**
2. **Make suitable assumptions wherever necessary.**
3. **Figures to the right indicate full marks.**

Q.1 **(a)** Write down the advantages of an under-reamed pile over pile foundation in cohesive soil? **09**

Find the ultimate load carrying capacity of triple under reamed pile of shaft diameter (d) 0.50 m embedded in the cohesive ground (Cu=50 kPa). The shaft distance upto first bulb is 3.0 m. Take under reamed diameter equal to three times shaft diameter and c/c spacing between two bulbs equal to two times under reamed diameter. The water table is touching the ground level. Ŭ = 0.70

(b) Briefly explain important location & depth criteria for the shallow foundations. **05**

Q.2 **(a)** In case of poor SBC, how a Raft footing will help? For a raft shown below, compute the contact pressure under the corner columns A, B, C & D. (Note: Loads are in kN and Fig. is not to the scale). **07**



(b) Data given:- **07**

- B x L = 2.0 m x 2.0 m
- Df = 2.0 m
- The load is 0.15 m eccentric along the x-x axis.
- Soil properties : γ_t = 17 kN/m^3 ; γ_{sat} = 19 kN/m^3 ;
  C = 0.0 kPa , ū = 38ę
  Compute the safe bearing capacity value for the Ground Water Table (GWT) position of 3.0 m below the GL. Use IS code method.

OR

(b) A 2.00 m x 3.00 m size footing is placed at 2.00 m depth below the ground level (GL) within a 8.0 m thick clay stratum. Ground water table (GWT) lies at 2.00 m depth below the GL. The clayey soil has γ_t = 17.5 kN/m^3, γ_{sat} = 20.10 kN/m^3, LL = 80%, G = 2.7 & water content below 2.0m depth = 25.46 %. If the net pressure intensity at the footing base = 180 kPa, divide the clay stratum in TWO PARTS and compute the settlement due to consolidation **07**

Q.3 **(a)** Differentiate between the different types of combined footings. **05**

(b) Data given: **09**

1. LHS column: 0.40m x 0.40m touching the property line on the left side. W1 = 1500 kN
2. RHS column: W2 = 1200 kN
3. c/c distance between column axes = 8.0 m
4. SBC = 230 kPa

Find size of the STRAP footing and draw shear force & bending moment diagrams mentioning typical values.

OR

Q.3 **(a)** What is importance of proportioning of shallow footings? Briefly explain the procedure for the same. **05**

(b) For the data given in Q5 (b) above, consider SBC = 120 kPa and find size of the TRAPEZOIDAL combined footing and draw only S.F. diagram mentioning typical values. **09**

Q.4 **(a)** The following data was obtained in a vertical pile load test on a 400 mm diameter pile:- **07**

Load(kN)	5.0	10.0	20.0	30.0	40.0	50.0	60.0
Settlement(mm)	2.5	4.0	9.5	16.5	27.0	40.5	61.0

Plot the load settlement curve and determine the allowable load as per IS code.

(b) A 3 x 3 = 9 pile group is embedded in uniform cohesive bed (Cu = 30 kPa, ū u = 0.0ę, γ_{sat} = 20 kN/m^3, G = 2.70, γd = 18.0 kN/m^3, LL= 50 %). The piles diameter and length are 0.50 m and 12.0 m respectively. Calculate the settlement of the pile group under the applied load of 3000 kN. **07**

OR

Q.4 **(a)** Briefly describe various methods of finding the lateral load carrying capacity of a pile. **07**

(b) A 20 m long steel pile is embedded in a deposit of uniform sand. The pile head is subjected to a horizontal force of 10 kN. Assuming the coefficient of subgrade modulus of 11,000 kN/m^3, calculate the deflection of free pile head. What will be the change in deflection if pile head is fixed? Assume EI of pile as 3.8 x 10^4 kN/m^2. The values of non dimensional coefficient at ground level are Ay = 2.435, By = 1.623 & As = -1.623, Bs = -1.750 **07**

Q.5 **(a)** Describe various methods of finding dynamic soil properties. **07**

(b) A cyclic plate load test on 60cm x 60 cm plate was carried out at a depth of 3.0m in a deposit of silty sand. The data obtained is given below:- **07**

Load(kPa)	20	0	50	0	80	0	120	0	140	0
Settlement(mm)	0.5	0.4	2.0	1.5	3.5	2.5	4.0	3.0	5.5	4.0

Load(kPa)	200	0	250	0	300	0	400	0
Settlement(mm)	7.0	5.5	10.0	8.0	12.5	10.0	20.0	17.0

Find the coefficient of elastic uniform compression Cu. Also find CŰ, $C_{Ø}$ and C_{Q} .

OR

Q.5 **(a)** What are the different types of well foundations? Under what situations these foundations are preferred? Also mention their merits and demerits. **07**

(b) A concrete block of weight 800 kN is resting over sandy clay bed having Cu = 35,000 kN/m^3. The block is subjected to horizontal oscillation under a dynamic force of 12 kN. If the base contact area is 10 m^2, find its natural frequency. If the operating frequency is 5 Hz, calculate the frequency ratio and magnification factor. Take damping factor = 0.2 and the weight the machine is one fifth of the weight of concrete block. **07**

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