Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

M. E. - SEMESTER – II • EXAMINATION – WINTER • 2014

Subject code: 1722005 Date: 04-12-2014

Subject Name: Advanced Foundation Engineering

Time: 02:30 pm - 05:00 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)** (i) A pile load test is made on a 400 mm diameter test pile and the following data are obtained:- **07**

Load(kN)	Settlement(mm)
0	0
300	1.25
600	3.75
900	7.50
1200	13.75
1500	23.75
1800	36.75

Determine the design/allowable load using F=2.5.

(ii) With a schematic diagram, show the load transfer mechanism in double under reamed pile and its expression for ultimate load carrying capacity.

(b) Mention the factors that may cause settlements and differential settlements. With neat sketches explain the different modes of baring capacity failures. **07**

Q.2 **(a)** A 4 x 4 = 16 pile group is embedded in uniform cohesive bed (Cu = 70 kPa, ū u = 0.0ę, ɔ$_t$ = 18 kN/m^3, G = 2.70, ɔd = 15.5 kN/m^3, LL= 70 %). The piles diameter and length are 0.40 m and 15.0 m respectively. Calculate the settlement of the pile group under the applied load of 3000 kN. **07**

(b) A concrete pile of diameter 0.40 m and length15 m is subjected to a lateral load of 4,000 N and a moment of 2000 N-m at the ground level. Taking $_h$ = 20 N/cm^3, find maximum bending moment and maximum deflection if the head of the pile is considered to be free, **07**

Z	Ay	By	Am	Bm
0	2.435	1.623	0.000	1.000
0.5	1.644	0.873	0.459	0.976
0.6	1.496	0.752	0.532	0.960
0.7	1.353	0.642	0.597	0.939
0.8	1.216	0.540	0.649	0.914
0.9	1.086	0.448	0.693	0.885
1.0	0.962	0.364	0.727	0.852
1.2	0.738	0.223	0.767	0.775

OR

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

Q.3 **(a)** Mention different types of combined footings and state in which circumstances the same shall be selected. Also state requirements for RAFT footing. **0□**

(b) Data given: **0□**

1. LHS column: 0.50m x 0.50m touching the property line on the left side. W1 = 2000 kN & M1 = 150 kN-m clockwise
2. RHS column: W2 = 1500 kN & M2 = 100 kN-m anticlockwise
3. c/c distance between column axes = 7.0 m
4. SBC = 250 kPa

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

OR

Q.3 **(a)** State the procedure for selection of foundation. Briefly explain the method of proportioning shallow footings. **0□**

(b) For the data given in Q3 (b) above, consider SBC = 120 kPa and find size of the TRAPEZOIDAL combined footing and draw only S.F. diagram mentioning typical values. **0□**

Q.4 **(a)** Explain Frequency Ratio , Magnification Factor and Damping Factor . Also explain Free Vibration with Damping and bring out the meaning of Over damped, Under damped and Critically damped conditions. **07**

(b) A concrete block of weight 750 kN is resting over sandy clay bed having Cu = 40,000 kN/m^3. The block is subjected to horizontal oscillation under a dynamic force of 10 kN. If the base contact area is 9 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 . **07**

OR

Q.4 **(a)** What is a Caisson ? How are Caissons classified based on the method of construction? Enumerate the various methods for the analysis of lateral stability of a well acted on by horizontal forces. **07**

Q.4 **(b)** Explain the various options of foundations on Expansive soils. Suggest few techniques for expansive soil s stabilization techniques. **07**

Q.5 **(a)** With neat sketches, explain about the important Location and Depth Criteria for the footings. **07**

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

- B x L = 2.0 m x 2.50m
- Df = 2.0 m
- The load is 0.15 m eccentric parallel to the width.
- Soil properties : $ɔ_t$ = 16 kN/m^3 ; $ɔ_{sat}$ = 18 kN/m^3 ; C = 33 kPa , ū = 27ę Compute the safe bearing capacity value for the Ground Water Table (GWT) position at 3.0 m below the GL.

OR

Q.5 **(a)** Briefly explain the Standard Penetration Test . How it is useful for computing safe bearing capacity and settlement of a shallow foundation? **07**

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

- B x B = 2.0 m x 2.0m
- Df = 2.0 m
- GWT lies at GL
- Load on column = 1200 kN
- 0.0m 10.0m: NC clay with $ɔ_{sat}$ = 20 kN/m^3, LL=70 % & G=2.70.

Divide the clay layer in THREE parts and compute the settlement due to consolidation.

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