Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

ME - SEMESTER–I(New course)• EXAMINATION – WINTER- 2015

Subject Code: 2712009 **Date: 04/01/2016**

Subject Name: Advanced Foundation Engineering

Time:2:30 pm to 5:00 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)** Point out important differences between shallow and deep foundations. List out different modes of bearing capacity failures. Briefly explain about different types of settlements in sandy and clayey soils. **07**

(b) 1) Explain the procedure for proportioning the shallow footings. **03**

2) What do you mean by liquefaction? Briefly explain the different mitigation methods. **04**

Q.2 **(a)** 1) Under which circumstance raft will be the most suitable type of footing? What is difference between a rigid raft and a flexible raft? For both types of rafts placed at ground level and on sand, sketch contact pressure diagrams. **04**

2) What do you mean by under damped and critically dampled foundations systems? **03**

(b) Data given: **07**

1. LHS column: 0.50m x 0.50m touching the property line on the left side. W1 = 2200 kN
2. RHS column: W2 = 1800 kN
3. c/c distance between column axes = 6.0 m
4. SBC = 250 kPa

Find size of the STRAP footing and draw only shear force diagram mentioning typical values.

OR

(b) For the data given in Q5 (b) above, consider SBC = 150 kPa and find size of the TRAPEZOIDAL combined footing and draw only S.F. diagram mentioning typical values. **07**

Q.3 **(a)** How under reamed piles are effective in expansive soils? Explain different techniques to deal with the expansive soils in the field. **07**

(b) A 2.5 m x 2.5 m size square footing is placed at 2.0 m depth below the ground level (GL). Soil properties are γ_t = 18 kN/m^3; γ_{sat} = 20 kN/m^3; C = 0.0 kPa & Φ = 32.0˚ (Nc=35.49, Nq=23.18, Nr=30.21). Use IS code method and compute the safe bearing capacity values for the Ground Water Table (GWT) position of 3.0 m below the GL. **07**

OR

Q.3 **(a)** Describe different types of well foundations. Under which circumstance well foundations will be the most suitable type of foundations? **07**

(b) 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.

Q.4 **(a)** What are the different methods of finding the lateral load carrying capacity of a pile? Descibe any one method. **07**

(b) A 4 x 4 = 16 pile group is embedded in uniform cohesive bed (Cu = 50 kPa, Φu = 0.0°, γ_{sat} = 20 kN/m^3, G = 2.70, γ_d = 14 kN/m^3, LL= 60 %). 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)** A concrete pile (M20) 0.4 m square in section and 7.0 m long embedded in sandy bed is subjected to a horizontal load of 6 kN and moment of 5 kN-m at GL. Taking horizontal subgrade reaction η_h = 20,000 kN/m^3, find deflection if (a) pile is free headed and (b) the head is fixed with no external moment. Take E = 3 x 10^7 kPa. **07**

Z	Ay	By	Am	Bm	As	Bs
0	2.435	1.623	0.000	1.000	-1.623	-1.750
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	--	--

(b) Explain negative skin friction on a pile. How to derive the magnitude of negative skin friction on a pile embedded in cohesive soil mass. **07**

Q.5 **(a)** List out the various dynamic soil properties required for the design of machine foundation. Briefly describe the methods of finding these parameters including Block Vibration Test conducted as per IS code. **07**

(b) A Block Vibration Test was performed on a concrete block (M20) of 1mx1mx1m using vertical excitation. If unit weight of concrete is 24 kN/m^3 , determine C_u & D for the given information:- **07**

f (rpm)	500	600	700	750	850	950	1000	1200
A_z (mm)	0.2	0.6	1.5	2.5	3.2	2.5	1.5	0.6

OR

Q.5 **(a)** Describe briefly Cyclic Plate Load Test for finding the dynamic soil properties. Give relationship between various other dynamic parameters. **07**

(b) Determine the natural frequency of a machine foundation which has a base area of 2m x 2m and weight of 150 kN including the weight of the machine. Take Cu as 4.5 x 10^4 kN/m^3. **07**

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