

GUJARAT TECHNOLOGICAL UNIVERSITY**M. E. - SEMESTER – II • EXAMINATION – WINTER • 2013****Subject code: 1722005****Date: 31-12-2013****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)** (i) Mention the factors causing settlements and differential settlements. **03**
 (ii) To the calculated total settlement, which corrections should be applied? Why? **04**
- (b)** Which laboratory tests help in identifying expansive nature of soils? What are the various precautions that need to be taken while laying foundations on such soils? **07**

- Q.2 (a)** A concrete pile of diameter 0.50 m and length 20 m is subjected to a lateral load of 5 kN and a moment of 3 kN-m at the ground level. Taking $\eta_h = 12,000 \text{ kN/m}^3$, 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

- (b)** A $5 \times 5 = 25$ pile group is embedded in uniform cohesive bed **07**
 ($C_u = 50 \text{ kPa}$, $\Phi_u = 0.0^\circ$, $\gamma_{\text{sat}} = 21 \text{ kN/m}^3$, $G = 2.70$, $\gamma_d = 19.0 \text{ kN/m}^3$, $LL = 60\%$). The piles diameter and length are 0.40 m and 12.0 m respectively. Calculate the settlement of the pile group under the applied load of 5000 kN. The ground water table is touching the ground level.

OR

- (b)** How will you calculate the ultimate load carrying capacity of a single and multi under reamed pile embedded in cohesive soil? **07**
- Q.3 (a)** Describe briefly (1) Cyclic Plate Load Test and (2) Block Vibration Test for finding dynamic soil properties. Give details of various properties thus obtained. **07**
- (b)** The following data refers to a vertical resonance test carried out on a 1.5 m x 0.75 m x 0.70 m high (M15) concrete block. **07**

f (cps)	15	18	20	22	23	24	26	27	29
Amp.(mm)	0.03	0.05	0.08	0.15	0.20	0.22	0.18	0.16	0.13

Make a frequency-amplitude plot and compute the coefficient of elastic uniform compression, C_u and damping coefficient of the soil at site.

OR

- Q.3 (a)** The resonance of a block foundation, excited by an oscillator was noted at 20 cps. The amplitude of vibration at resonance was 1.0 mm. The dynamic force magnitude of the oscillator at 20 cps is 5 kN. If the total weight of the block and oscillator is 20 kN, calculate the damping factor associated with the system. **07**

- (b) 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**

- Q.4 (a)** Write a short note on important location and depth criteria. **07**
(b) Data given:- **07**

- $B \times L = 2.0 \text{ m} \times 2.0 \text{ m}$
- $D_f = 2.0 \text{ m}$
- Soil properties :very stiff Black Cotton soil with $\gamma_t = 19 \text{ kN/m}^3$; $\gamma_{\text{sat}} = 21 \text{ kN/m}^3$; $C = 100.0 \text{ kPa}$ & $\Phi = 0.0^\circ$

Compute the safe bearing capacity value for the Ground Water Table (GWT) position of 2.0 m below the GL. Use IS code method.

OR

- Q.4 (a)** In cohesionless deposits, why Standard Penetration Test (SPT) is more reliable? **07**
 Following are the SPT i.e. N values observed in a 15.0 m thick sand deposit ($\gamma_t = 15 \text{ kN/m}^3$; $\gamma_{\text{sat}} = 17 \text{ kN/m}^3$). The ground water table lies at 4.0 m depth. Compute the corrected SPT values:-

Depth (m)	2.0	4.0	6.0	8.0	10.0
N / 30 cm	10	08	14	24	31

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

- $B \times B = 2.0 \text{ m} \times 2.0 \text{ m}$
- $D_f = 2.0 \text{ m}$
- GWT lies at 2.0 m depth below the GL
- Net pressure intensity at the footing base = 200 kPa
- 0.0m – 6.0m: OC clay with $\gamma_t = 18 \text{ kN/m}^3$; $\gamma_{\text{sat}} = 20 \text{ kN/m}^3$, $m_v = 5 \times 10^{-5} \text{ m}^2/\text{kN}$ & $G=2.70$.

Divide the clay layer in two parts and compute the settlement due to consolidation. Why the clay layer shall be divided into small parts?

- Q.5 (a)** Mentioning merits and demerits, write a brief note on different types of caissons. **05**

- (b)** Data given: **09**

1. LHS column: 0.40m x 0.40m touching the property line on the left side. $W_1 = 1800 \text{ kN}$
2. RHS column: $W_2 = 1500 \text{ kN}$
3. c/c distance between column axes = 7.0 m
4. SBC = 245 kPa

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

OR

- Q.5 (a)** Data given: **07**

1. LHS column: 1.0 m away from the property line on the left side. $W_1 = 1500 \text{ kN}$
2. RHS column: $W_2 = 1800 \text{ kN}$
3. c/c distance between column axes = 6.0 m
4. SBC = 140 kPa

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

- (b) For a raft shown below, compute the contact pressures under all columns. **08**
Loads are in kN. (Fig. is not to the scale).


