

GUJARAT TECHNOLOGICAL UNIVERSITY**M.E Sem-II Remedial Examination December 2010****Subject code: 722005****Subject Name: Advanced Foundation Engineering****Date: 21 /12 /2010****Time: 02.30 pm – 05.00 pm****Total Marks: 60****Instructions:**

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

Q.1 (a) A 1.50 m x 2.00 m size footing placed at 1.50 m below the ground level (GL) is transmitting 600 kN load through the column. The necessary data is given below:- **06**

- (1) Top layer : 1.50m thick SAND, $\gamma_t = 16.0 \text{ kN/m}^3$
- (2) Middle layer: 3.00m thick OC CLAY, $\gamma_{\text{sat}} = 21.00 \text{ kN/m}^3$ & $m_v = 5 \times 10^{-4} \text{ m}^2/\text{kN}$.
- (3) Bottom layer : Sand

Divide the clay layer in three equal parts and compute the settlement due to consolidation (Sc).

(b) A 5 x 5 = 25 pile group is embedded in uniform cohesive bed **06**
 ($C_u = 20 \text{ kPa}$, $\Phi_u = 0.0^\circ$, $\gamma_t = 18 \text{ kN/m}^3$, $G = 2.70$, $\gamma_d = 16 \text{ kN/m}^3$, $LL = 50\%$). The piles diameter and length are 0.40 m and 10.0 m respectively. Calculate the settlement of the pile group under the applied load of 4000 kN.

Q.2 (a) Data given: **06**

- $D_f = 2.00 \text{ m}$
- GWT = 3.00 m below the GL
- Soil properties : $\gamma_t = 19 \text{ kN/m}^3$; $\gamma_{\text{sat}} = 21 \text{ kN/m}^3$;
 $C = 0.00 \text{ kPa}$, $\Phi = 36^\circ$ ($N_q = 37.7$ & $N_r = 56.2$)

Consider FOS = 5.0 and compute the safe bearing capacity values for (i) a square footing of 2.00 m x 2.00 m size

- (ii) a rectangular footing of 2.00 m x 3.00 m size
- (iii) a circular footing of 2.00 m diameter
- (iv) a strip footing of 2.00 m width

Give comment on the results.

- (b)** 1) State the factors governing safe bearing capacity (SBC). In case of lower SBC, how can it be improved? **03**
 2) Explain different factors governing total and differential permissible settlement values. **03**

OR

(b) For the shallow foundations, briefly describe important 'Location and Depth criteria'. Mention importance of the same. **06**

Q.3 (a) Data given: **06**

1. LHS column: $W_1 = 1100 \text{ kN}$
2. RHS column: $W_2 = 1500 \text{ kN}$
3. c/c distance between column axes = 6.00 m
4. SBC = 160 kPa

Find size of the RECTANGULAR COMBINED footing and draw S.F. & B.M. diagrams mentioning typical values.

(b) Under which circumstances the well foundations will be useful? Explain different types of the same and state loads to be considered. **06**

OR

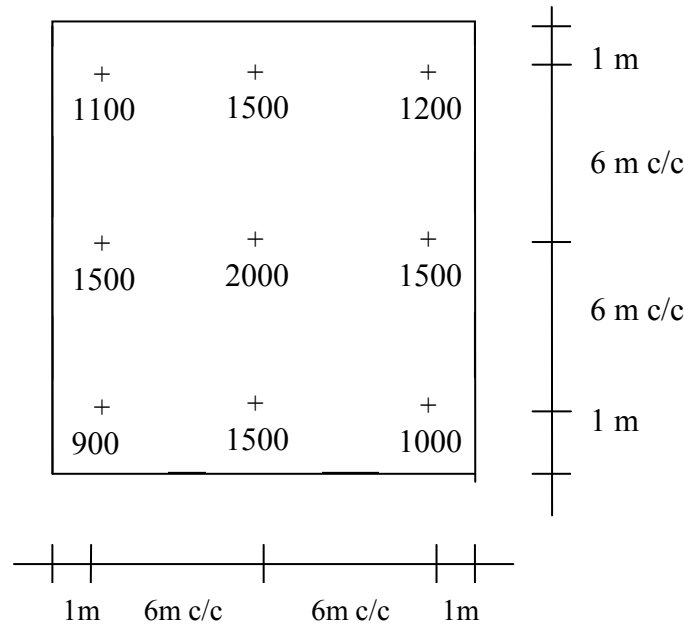
Q.3 (a) Data given:

06

1. LHS column: axis 1.0m away from the property line on left side of the column, $W_1 = 2000$ kN
2. RHS column: $W_2 = 1400$ kN
3. c/c distance between column axes = 7.00 m
4. SBC = 140 kPa

Find size of the TRAPEZOIDAL combined footing and draw only S.F. diagram mentioning typical values.

- (b)** In case of poor SBC, how the raft is helpful? 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).



- Q.4 (a)** List out the various methods of finding out Modulus of Shear Rigidity 'G' and Coefficient of Elastic Uniform Compression 'Cu'. Show relation between C_u , C_τ & C_ϕ . 06

- (b)** Describe Block Vibration Test and method of finding Damping Coefficient 'D' and Coefficient of Elastic Uniform Compression 'Cu'. 06

OR

- Q.4 (a)** 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 C_u as 4.5×10^4 kN/m³. 06

If the operating frequency of the machine is 500 rpm, calculate displacement amplitude, z for undamped oscillation.

- (b)** Using Lysmer Lumped parameter method calculate K_z and D for the following information :- 06

- 1) The size of M20 concrete block = 2m x 2m x 2m.
- 2) The weight of machine = $1/5^{\text{th}}$ the weight of the concrete block.
- 3) $G = 25000$ kPa.
- 4) μ for sandy bed = 0.25
- 5) for sandy bed $\gamma_t = 16$ kN/m³

- Q.5 (a)** A concrete pile (M20) 0.5m square in section and 10.0 m long embedded in sandy bed is subjected to a horizontal load of 4 kN and moment of 2 kN-m at GL. Taking horizontal subgrade reaction $\eta_h = 12,000$ kN/m³, find deflection if (a) pile is free headed and (b) the head is fixed with no external moment. 06

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) With a schematic diagram describe the usefulness of under-reamed pile foundation and give expression for its load carrying capacity in different soil conditions. **06**

OR

- Q.5 (a)** 1) What are the various measures to be taken for foundations on expansive soils? **06**
 2) Calculate the swelling pressure of a clayey soil having $\gamma_d = 16 \text{ kN/m}^3$, $G=2.7$, $LL = 60\%$, $PL = 18 \%$.
- (b) A cantilever retaining wall is to be constructed to retain a sandy backfill. The following are the data:- **06**
 Height of backfill above grade = 6.00 m
 Inclination of the backfill with horizontal = 15° , $\Phi = 30^\circ$,
 $\gamma_t = 18 \text{ kN/m}^3$. Determine the tentative dimension and various forces acting on the wall. Also check the stability of the wall against overturning and sliding.
