Seat No.: _____ *Enrolment No._____*

GUJARAT TECHNOLOGICAL UNIVERSITY

M. E. Sem. – II[nd] - Examination – June/July- 2011

Subject code:1722005

Subject Name: Advanced Foundation Engineering

Date:27/06/2011 **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.**

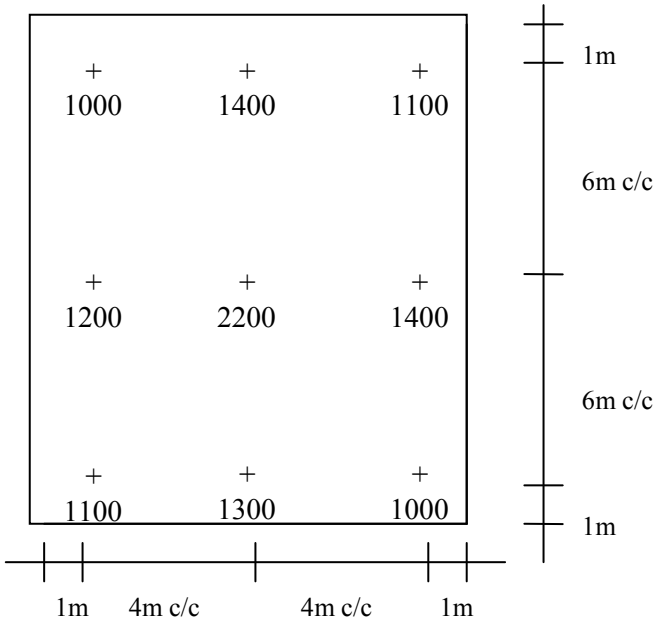
Q.1 **(a)** Define the terms safe bearing capacity, safe bearing pressure and allowable bearing pressure. With neat sketches explain the different modes of baring capacity failures. **07**

(b) A cantilever wall is to be constructed to retain a sandy backfill with horizontal top. The following are the data: **07**

(i) Height of backfill above grade = 5.50 m
(ii) $\Phi = 38^\circ$ & $\gamma_t = 18$ kN/m^3
(iii) Depth of embedment = 1.50 m
(iv) Base width B = 4.0 m
(v) Thickness of stem top $t_0 = 0.30$ m
(vi) Thickness of base slab $t_b = 0.65$ m
(vii) Thickness of stem bottom $t_s = 0.85$ m
(viii) Length of toe $L_t = 1.20$ m

Determine the tentative forces acting on the wall and check the stability.

Q.2 **(a)** In which circumstances the Raft will be useful? For a raft shown below, compute the contact pressure under the corner points. If SBC = 100 kPa, give comments on the results. Loads are in kN. (Fig. is not to the scale). **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 : γ_t = 18 kN/m^3 ; γ_{sat} = 20 kN/m^3 ; C = 21 kPa , Φ = 32˚ (Nc = 35.14, Nq = 28.40, Nr = 34.04)

Consider General Shear Failure (GSF) and compute the safe bearing capacity values for the Ground Water Table (GWT) positions of 3.0 m and 2.0 m below the GL.

OR

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

- B x B = 1.5 m x 2.0m
- Df = 2.0 m
- GWT lies at GL
- Load on column = 1500 kN
- 0.0m – 7.0m: NC clay with γ_{sat} = 19 kN/m^3, LL=80 % & G=2.70.

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

Q.3 **(a)** For determining the dynamic soil properties, describe with schematic diagram **07**

(i) Cyclic Plate Load Test and

(ii) Block Vibration Test

(b) A reciprocating engine is attached to a concrete block resting over a sandy clayey soil having γ_t = 18 kN/m^3, μ = 0.25 and G = 20,000 kN/m^2. **07**

Engine data:-

- Weight of engine = 10 kN
- Operating frequency = 1000 rpm

Foundation block:-

- Base area = 9 m^2
- Weight = 750 kN.

The unbalanced dynamic vertical force is 20 kN. Check whether the foundation block is suitable by Lysmer Lumped Parameter Method.

OR

Q.3 **(a)** A block vibration test was performed on a concrete block of 1.0 m x 1.0 m x 1.0 m using vertical excitation. If γ_t of concrete is 24 kN/m^3, determine Cu and 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

(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**

Q.4 **(a)** Give the applications of under reamed piles depending upon the site conditions. With a schematic diagram give details of a multi under reamed pile and give the expression for the ultimate load carrying capacity. **07**

(b) As per IS code method, calculate the (a) length of fixity, Z_f and (b) deflection of a free headed pile of 0.45 m diameter and 15 m long, installed in a sandy bed. Take coefficient of subgrade reaction η_h is 10,000 kN/m^3 and horizontal force 30 kN. Assume E of concrete = 20 kN/mm^2, e = 0.0 For e/T = 0, Z_f/T = 1.92 . **07**

OR

Q.4 **(a)** A 3 x 3 = 9 pile group arranged in a square pattern is embedded in uniform clay having data:- **07**

- Pile : diameter = 0.50 m, length = 12 m
- Clay : Cu = 50 kPa, Φu = 0.0° , α = 0.7, γ_t = 16 kN/m^3 , LL = 50 %, w_n = 30 %, e_o = 1.19.

The group is subjected to a vertical loading of 2000 kN. Calculate the total settlement of the pile group.

(b) A concrete pile of diameter 0.50 m and length 20 m is subjected to a lateral load of 4,000 N and a moment of 2000 N-m at the ground level. Taking η_h = 12,000 kN/m^3, find maximum bending moment and maximum deflection if the head of the pile is considered to be free, and **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

Q.5 **(a)** In which circumstances the strap footing will be useful? State important considerations for the strap footing. **05**

(b) Data given: **09**

1. LHS column: 0.40m x 0.40m touching the property line on the left side. W1 = 1400 kN & M1 = 100 kN-m clockwise
2. RHS column: W2 = 1100 kN & M2 = 80 kN-m anticlockwise
3. c/c distance between column axes = 7.0 m
4. SBC = 220 kPa

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

OR

Q.5 **(a)** Briefly explain the method of proportioning shallow footings. In which circumstances the isolated footings shall be combined? **05**

(b) For the data given in Q5 (b) above, consider SBC = 130 kPa and find size of the TRAPEZOIDAL combined footing and draw only S.F. diagram mentioning typical values. **09**

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