Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

ME – SEMESTER-1 (NEW) EXAMINATION – WINTER 2016

Subject Code: 2712009 **Date:06/01/2017**

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.**
4. **Use of IS: 8009(part I – II), IS:2911-2010, IS:5249-1992, IS:1904, IS:6403, IS:2950(part I) and other related IS code are permitted.**

Q.1 **(a)** A concrete block foundation of size 4 m x 3 m x 3 m(high), with a symmetrically mounted machine (70 kg.) on it, operating at 300 r.p.m. under maximum vertical exciting force of 4 kN. The damping ratio of soil-foundation system $\xi = 0.25$. The co-efficient of uniform compression $C_u = 3.5 \times 10^4$ kN/m^3. Check the suitability of machine foundation if the limiting amplitude of machine is 1 mm. Assume the resonance takes place in frequency ratio (w/w_n) limit 0.5 to 1.5. Use Spring-Mass Model. **07**

(b) Check the suitability of above(Q.-1, a) machine foundation using Elastic Half space Model. Assume the foundation resting on a soil having $\text{Ø} = 30^0$, $\gamma = 16$ kN/m^3, $G = 1.10 \times 10^4$ kN/m^2, $E = 2.98 \times 10^4$ kN/m^2 and $\mu = 0.35$. **07**

Q.2 **(a)** Explain the general criteria for the design of machine foundation. **07**

(b) A rigid square footing as shown in fig.-1, transmit a axial load on a uniform soil deposit with following soil properties: C = 15 kN/m^2, $\text{Ø} = 38^0$, $\gamma = 18$ kN/m^3 and $\gamma_{sat} = 12$ kN/m^3. Calculate the safe bearing capacity of a footing as per IS: 6403 with factor of safety 2.5 against shear failure. **07**

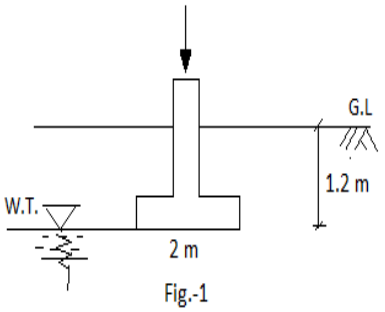

Fig.-1

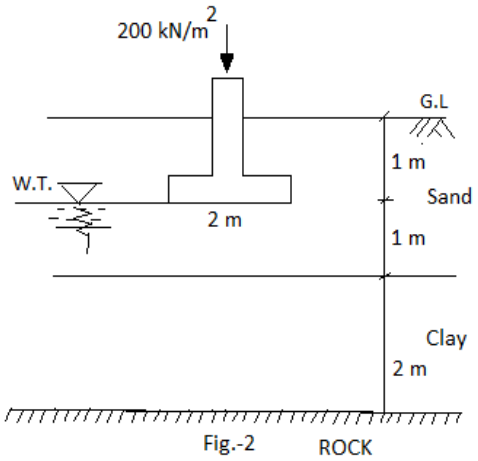

Fig.-2

OR

(b) Answer the following: **07**

1-) In case of eccentric loads, why shall the size of the footing be modified?[03]

2-) Differentiate the following terms: Net Bearing Capacity, Safe Bearing Capacity, Allowable Bearing Capacity. [04]

Q.3 **(a)** For a rigid square footing as shown in fig.-2, find the settlement of footing as per IS:8009(part- I) with following soil properties: **07**

$\gamma_{sand} = \gamma_{clay} = 20$ kN/m^3 and $\gamma_{sat} = 12$ kN/m^3.

$C_c = 0.18$, $e_o = 0.60$.

Neglect the immediate settlement.

(b) Enlist the conditions responsible for Liquefaction to take place in soil. Also suggest the different way to mitigate the Liquefaction with suitable justification. **07**

OR

Q.3 **(a)** A footing 4m x 3m in plan, transmits a pressure of 150 kN/m^2 on a cohesive soil having E_s = 6 x 10^4 kN/m^2 and μ = 0.5. Determine the immediate settlement of the footing at the centre as per IS:8009(part- I), assuming it to be **07**

1-) a flexible footing and

2-) a rigid footing.

(b) Enlist the different approach used for the analysis of soil-structure interaction analysis. Also state the difference between them. **07**

Q.4 **(a)** Answer the following: **07**

1-) Differentiate the terms: Friction Pile, Bearing Pile. [2]

2-) What is Negative Skin Friction? [2]

3-) Justify the statement: " The vertical load carrying capacity in a sandy soil is generally independent of pile size" [3]

(b) The following data was obtained in a vertical pile load test on a 400 mm diameter of pile: **07**

Load (kN)	5	10	20	30	40	50	60
settlement (mm)	2.5	4	9.5	16.5	27	40.5	61

Plot the load settlement curve and determine the allowable load as per IS code.

OR

Q.4 **(a)** Design a friction pile group to carry a load of 3000 kN including the weight of the pile cap at a site where the soil is uniform clay to a depth of 20 m underlain by rock. The average unconfined compressive strength of the clay is 70 kN/m^2. A factor of safety 2.5 is required against shear failure. Assume adhesion factor α = 1. The pile is of 10 m length with 0.5 m diameter. **07**

(b) In the above example (Q-4, a OR), assuming the clay to be of normal sensitivity and normally loaded with liquid limit of 60 %, compute the settlement of pile group as per guidelines given in IS: 8009(part-II). The unit weight of clay γ = 18 kN/m3. **07**

Q.5 **(a)** State the difference between Elastic half space approach and Winkler spring-mass model approach for carrying out Soil-Structure Interaction analysis. **07**

(b) Suggest different measures to be taken for foundation on expansive soil along with suitable justification. **07**

OR

Q.5 **(a)** Answer the following w.r.t. Raft foundation: **07**

1-) What is minimum depth of foundation.

2-) Under which situations one can go for raft foundation.

3-) State the criteria for considering raft as rigid or flexible for analysis.

4-) Draw a typical sketch for various types of raft foundation.

(b) What are the different types of well foundations? Under what situations these foundations are preferred? Also mention their merits and demarits. **07**

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