Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

M.E -IVth SEMESTER–EXAMINATION – MAY- 2012

Subject code: 742001 Date: 12/05/2012

Subject Name: Soil Structure Interaction

Time: 02:30 pm – 05:00 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)** Briefly explain the various techniques of finding out the Dynamic soil properties. **07**

(b) How do you explain the Liquefaction phenomenon? Check the Liquefaction potential of a site for the given data:- **07**

Depth(m)	1.0	2.0	4.0	6.0	8.0	10.0	12.0
N	07	06	05	04	08	20	22
r_d	1.0	0.98	0.97	0.95	0.91	0.89	0.85
CSR (τ_{av}/σ_0')	0.05	0.045	0.04	0.039	0.08	0.22	0.24

Take $\alpha = 0.3g$, r_{sat} =18 kN/m^3 .GWT is touching the GL.
% fines = 5%

Q.2 **(a)** Compare the study of the subject 'Soil-Structure-Interaction' with the study of the conventional subject 'Soil Mechanics & Foundation Engineering". Enlist the different design methods of analysis and design of foundations. Name and differentiate the main theories which are used in the study of 'Soil-Structure-Interaction'. **07**

(b) Find the depth of embedment for a cantilever sheet pile of height 6 m having non-cohesive backfill throughout. The GWT is touching the top of the sheet pile and r_{sat} =18 kN/m^3 and Ø = 30° Use approximate analysis. **07**

OR

(b) Draw pressure distribution diagram for an anchored sheet pile having non-cohesive backfill throughout and give the analysis of finding depth of embedment and force in the anchor rod. **07**

Q.3 **(a)** Design a geotextile wall of height 4.0m for internal stability only having surcharge, q = 10 kPa. Sand (r_t =18 kN/m^3 and Ø = 36°) is to be used as a backfill material. The ultimate tensile strength of geotextile is 45 kN/m. **07**

(b) At a site a building is to be constructed on the soft clay bed (Cu = 20 kPa, Φu = 0.0, γ_t = 16 kN/m^3). If the width of the strip footing is 1.0m, calculate the ultimate bearing capacity of the footing. If a sand band of 0.8B is placed over the soft clay with a geotextile at the interface, calculate the improvement in the bearing capacity. **07**

OR

Q.3 **(a)** Explain with neat sketches the bearing capacity analysis of reinforced foundation bed by Binquet & Lee method. **07**

(b) A strip footing of width 1.0m is resting on a sandy bed having four layers of geotextile reinforcement at depth of 0.3m from the base of footing. The vertical spacing between two consecutive geotextiles is 0.3m. If the properties of sand is C = 0.0, Ø = 30° & γ_t = 18 kN/m^3, calculate the tension developed in each reinforcement layer for bearing capacity ratio equal to two. **07**

z/B	0.3	0.6	0.9	1.2
J(z/B)	0.35	0.34	0.33	0.32
I (z/B)	0.28	0.21	0.19	0.15

Q.4 **(a)** State different factors affecting the contact pressures below the shallow footings. With neat sketches, explain any two of them. **07**

(b) 1) Explain: If a footing is placed at depth Df = B/2 in SAND, instead of placing on surface, the elastic settlement will reduce by half. **02**

2) Explain the influence of Rigidity of Super Structure on the differential settlement of foundation. **05**

OR

Q.4 **(a)** State important assumptions made by 'Winkler' for his hypothesis. What the 'Winkler Model' consists of? State limitations of the same if any. **07**

(b) Define 'Modulus of Subgrade reaction' & briefly explain important factors affecting the same. **07**

Q.5 **(a)** A rectangular combined footing has L = 8.0 m, B = 2.0 m and EI = 1600 MN-m^2. A 1.0 MN point load is acting at 2.0 m distance from the left edge and 2.0 MN point load is acting at 2.0 m from the right edge. Modulus of the subgrade for plate is determined to be 80 MN/m^3 within the clayey foundation soil. Divide the foundation in two elements only and by Finite Difference Method (FDM), determine y (settlement), q (contact pressure), SF & BM values at the nodal points. **10**

(b) Compare the results obtained in Q.5 (a) with the results obtained by Rigid method. **04**

OR

Q.5 **(a)** A rectangular combined footing has L = 8 m, B = 2 m and EI = 1200 MN-m^2. One 2 MN point load is acting at 2 m distance from the left edge and the second 2 MN point load is acting at 2 m from the right edge. Modulus of the subgrade for plate is determined to be 60 MN/m^3 within the clayey foundation soil. Divide the foundation in FOUR elements and by Finite Difference Method (FDM), determine y (settlement), q (contact pressure), SF & BM values at the nodal points. **10**

(b) Compare the results obtained in Q.5 (a) with the results obtained by Rigid method. **04**

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