Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

ME - SEMESTER–IV • EXAMINATION – WINTER • 2014

Subject Code: 742001 Date: 26-11-2014

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)** Enlist the different methods of analysis and design of foundations. Why the soil structure interaction methods can be considered as flexible methods? **07**

(b) Define ôLiquefactionô and explain different mitigation techniques. **07**

Q.2 **(a)** Calculate the cyclic stress ratio developed at the site for the given data:- **07**

Depth(m)	1.0	2.0	3.0	6.0	8.0	10.0	12.0
N	06	08	10	08	15	20	22
r_d	0.99	0.98	0.96	0.93	0.90	0.88	0.85

Take a_{max} = 0.2g, r_{sat} =17 kN/m^3 .GWT is touching the GL. Also check the liquefaction potential at 3.0 m depth if CRR is 0.12.

(b) A 9.0 m high reinforced earth wall is reinforced with metal strips (b = 100mm, t = 5 mm, f_y = 240 MPa). The sandy backfill and the reinforced soil has r =17 kN/m^3 , ū = 36ę , ŭ= 25ę,and the spacing(horizontal*vertical) = 1m*1m. The total number of reinforcing elements are 9. The first reinforcement is placed at a depth of 0.5 m from the top of the backfill and the last one at a depth of 8.5 m from the top of the backfill. Take factor of safety on soil friction as 1.5. **07**

Calculate :-

(1) Total length of reinforcement and effective length,

(2) Tension developed in each strip.

OR

(b) Step by step explain the procedure of constructing a reinforced wall. Illustrate the method of finding the factor of safety against external stability. **07**

Q.3 **(a)** With schematic diagrams, explain the various techniques of finding out the Dynamic soil properties. **07**

(b) A cyclic Triaxial test was performed over a saturated clayey sample and the maximum deviatoric stress at the axial strain of 1.4 % was 236 kPa. Find E & G at 1.4 % axial strain. The area of the hysteresis loop and the area of the triangle are 4.52 kPa and 1.65 kPa respectively. Calculate the damping coefficient. Take poissonôs ratio as0.5. **07**

OR

Q.3 **(a)** For a cantilever sheet pile embedded in sandy deposit, draw the pressure distribution diagram and show how to calculate the depth of embedment. **07**

(b) A cyclic plate load test was carried out on a deposit of silty sand at a depth of 3 m using 30 cm x 30 cm test plate. The data are:- **07**

Load Intensi (kPa)	25	0	50	0	75	0	100	0	150	0	200	0
Settlement (mm)	0.5	0.4	0.95	0.80	1.60	1.25	2.50	1.90	3.60	2.60	4.80	3.80

Calculate C_U , CŰ,$C_ø$.

Q.4 **(a)** Enlist the different factors affecting contact pressures under the spread footings. With neat sketches, explain effect of soil type on contact pressures and settlements of a flexible footing placed at the ground level. **07**

(b) For an ordinary footing of finite rigidity (i.e. neither perfectly flexible nor perfectly rigid) placed on sand and carrying a point load, sketch and compare the contact pressures developed by theory of elasticity, theory of subgrade reaction and rigid method. In which case the bending moment at centre will be maximum? **07**

OR

Q.4 **(a)** Enlist the different factors affecting contact pressures under the spread footings. If a point load is increased from elastic to ultimate value then what would be its effect on contact pressures of a perfectly rigid footing? Explain with the help of neat sketches. **07**

(b) Define modulus of subgrade (k_h & k_v). For the same soil type, will they be different or same? Why? **07**

Q.5 **(a)** In context of soil types, explain the effects of coupled and uncoupled springs. **07**

(b) For a rail road/rail track as a beam on elastic foundation, explain how Hetenyi's solution can be used? Mention limitations of the same. **07**

OR

Q.5 **(a)** A rectangular combined footing has L = 6.0 m, B = 1.50 m and EI = 2200 MN-m^2. One point load of 1.0 MN is acting at 1.50 m distance from the left edge and second point load of 1.0 MN is acting at 1.50 m from the right edge. Modulus of the subgrade for plate is determined to be 75 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. **07**

(b) Compare the results obtained in Q.5 (a) above with the results obtained by Rigid method. **07**

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