Seat No.: _____ Enrolment No._____

# GUJARAT TECHNOLOGICAL UNIVERSITY

**ME - SEMESTER–IV • EXAMINATION – SUMMER 2013**

**Subject Code: 742001** **Date: 14-05-2013**

**Subject Name: Soil Structure Interaction**

**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)** Write a detailed note on geotextiles giving a list of various types of geotextiles. **07**

**(b)** Give the basic concept of soil-structure interaction and state how it differs from the conventional subject of soil mechanics and foundation engineering. **07**

**Q.2** **(a)** Define liquefaction. Explain briefly various factors influencing the process of liquefaction. **07**

**(b)** Check the liquefaction potential of a site for a given data. Take $a_{max}$ = 0.3g, ground water table is at 2.0m depth. **07**

| Layer No. | 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|---|
| Depth, m | 0-2 | 2-6 | 6-8 | 8-12 | 12-16 |
| Unit weight, kN/m$^3$ | 19.2 | 19.3 | 19.4 | 19.3 | 19.6 |
| N | 12 | 12 | 5 | 15 | 4 |
| FC, % | 5 | 5 | 35 | 5 | 35 |
| $r_d$ | 0.98 | 0.95 | 0.94 | 0.85 | 0.75 |

**OR**

**(b)** Enlist various liquefaction mitigation techniques. Explain any one briefly. **07**

**Q.3** **(a)** Determine the depth of embedment for a cantilever sheet pile for the given data using approximate method of analysis: (1) height of cohesionless backfill above dredge line = 7.0m, (2) unit weight of soil = 1.8T/m$^3$ (3) $\Phi = 38^o$and (4) $\delta = 20^o$ **07**

**(b)** Draw the 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**

**OR**

**Q.3** **(a)** Determine the depth of embedment of the anchored sheet pile. Also determine the force per metre of the wall. Assume free earth support condition. (1) height of cohesionless backfill above dredge level = 8.0m, (2) anchor depth below the ground surface = 3.0m (3) unit weight of soil = 16 kN/m$^3$ (4) $\Phi = 35^o$ **07**

**(b)** What are different types of sheet pile walls? Draw the sketches showing the pressure distribution. **07**

**Q.4** **(a)** Explain with the help of a neat sketch various elements of a reinforced earth wall, stating the specifications, requirements and functions of each element. **07**

**(b)** Design a geotextile wall of height 5.0m for internal stability. The surcharge acting is 18kPa.The cohesionless backfill is having unit weight of 18kN/m$^3$ and angle of internal friction is $35^o$. The ultimate tensile strength of the geotextile is 45kN/m. **07**

**OR**

**Q.4** **(a)** A rectangular combined footing with L = 5.5m and B = 1.8m is having EI = 1300MN/m$^2$. A 1000kN load is acting at 0.6m from the left edge and 1500kN load is acting at a distance of 1.3m from the right edge. The modulus of subgrade for plate is determined to be 75MN/m$^3$ within a clayey foundation soil. Divide the foundation in two elements and by FDM determine settlement, contact pressure, SF and BM at the nodal points. **07**

**(b)** Enlist the different elastic methods of analysis for a beam on elastic foundation. Briefly explain Wrinkler's model. State the limitations of the same if any. **07**

**Q.5** **(a)** Draw and explain the settlement profiles for perfectly flexible footings resting on clayey strata and sandy strata. What should be done to achieve uniform settlement? **07**

**(b)** Briefly explain various factors affecting modulus of subgrade reaction. **07**

**OR**

**Q.5** **(a)** A rectangular combined footing with L = 6.0m and B = 1.6m is having EI = 1200MN/m$^2$. A 1200kN load is acting at 1.0m from the left edge and 1200kN load is acting at a distance of 1.0m from the right edge. The modulus of subgrade for plate is determined to be 70MN/m$^3$ within a clayey foundation soil. Divide the foundation in four elements and by FDM determine settlement, contact pressure, SF and BM at the nodal points. **07**

**(b)** Solve Q-5 (a) using Rigid method and compare the results so obtained. **07**

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