# GUJARAT TECHNOLOGICAL UNIVERSITY
## BE – SEMESTER- V EXAMINATION-SUMMER 2023

**Subject Code: 3150615**                                    **Date: 28/06/2023**
**Subject Name: Soil Mechanics**
**Time: 02:30 PM TO 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.**
4. **Simple and non-programmable scientific calculators are allowed.**

| | | | Marks |
|---|---|---|---|
| **Q.1** | **(a)** | Define types of foundation. Explain various steps in selection of type of foundation for different structures. | **03** |
| | **(b)** | Explain working principle of SPT test and its application. | **04** |
| | **(c)** | Define subsurface investigation. Give various objectives and Planning for carrying out subsurface exploration. Explain any one type of geophysical exploration method used in field along with its applications. | **07** |
| **Q.2** | **(a)** | Write critically note on Pile classification | **03** |
| | **(b)** | Explain the functions of (i) Batter pile (ii) Fender pile (iii) End bearing pile (iv) Friction pile | **04** |
| | **(c)** | Explain Negative skin friction for Cohesive Soil and Cohesion less Soil | **07** |
| | | **OR** | |
| | **(c)** | Explain in detail plate load test | **07** |
| **Q.3** | **(a)** | Explain Newmark's influence Chart and its application. | **03** |
| | **(b)** | Enlist theories regarding distribution of stresses in soil. Derive equation for stress distribution of soil under a point load as per Boussinesq's theory. | **04** |
| | **(c)** | Explain causes of stress in soil. What is geostatic stress? What are different factors of safety used in the stability of slopes? Discuss briefly. | **07** |
| | | **OR** | |
| **Q.3** | **(a)** | Discuss briefly, different types of slope failures. | **03** |
| | **(b)** | Explain Taylor's Stability Number in relevant terms. | **04** |
| | **(c)** | How is a slope analyzed using a Swedish circle method (method of slices)? Discuss the method and derive an expression for the factor of safety. | **07** |
| **Q.4** | **(a)** | Explain the principle of the Direct shear test. What are the advantages of this test? | **03** |
| | **(b)** | Enlist factor affecting the bearing capacity and explain any two in detail. | **04** |

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|---|---|---|---|
| | **(c)** | Define Safe, Allowable, Ultimate and net bearing capacity of soil. Write down Terzaghi's bearing capacity equation in detail, its assumption and limitation of analysis | **07** |

**OR**

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| **Q.4** | **(a)** | What is the effect of increase in width of a footing on bearing capacity of a footing resting on (a) sand and (b) clay? | **03** |
| | **(b)** | Critically explain effect of G.W.T. on bearing capacity of soil. | **04** |
| | **(c)** | A square footing has dimensions of 2mx2m and depth 2m. Determine its ultimate bearing capacity in pure clay with UCS of $0.15 \text{ N/mm}^2$, $\phi = 0^0$  $\gamma = 1.7\text{g /cm}^3$. Assume Terzaghi's factor for $\phi = 0^0$  as $N_c = 5.7$, $N_q = 1.0$, $N_\gamma = 0$. | **07** |

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|---|---|---|---|
| **Q.5** | **(a)** | Discuss the UU, CU, and CD triaxial shear test conditions | **03** |
| | **(b)** | Explain the principle of the Direct shear test. What are the advantages of this test? | **04** |
| | **(c)** | Following are the results obtained from box shear test on soil: | **07** |

Normal Stress $(\text{kN/m}^2)$ : 25, 75, 150, 250

Shear Stress   $(\text{kN/m}^2)$ :  60, 80, 105, 145

Plot graph and determine the shear values C and $\phi$ of soil. If a specimen of same soil is tested in triaxial test, estimate the deviator stress $(\sigma_d)$ at which the sample will fail when cell pressure $(\sigma_3)$ is $100 \text{ kN/m}^2$

**OR**

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|---|---|---|---|
| **Q.5** | **(a)** | Different between shallow foundation and deep foundation. | **03** |
| | **(b)** | Explain the concept of 'Pressure bulb' and its use in soil engineering practice. Draw contact pressure distribution diagram for flexible and rigid footings on sand and clayey soil. | **04** |
| | **(c)** | Define 'GEOSYNTHETICS'. Classify the geosynthetic materials and explain any two of them with neat sketch. | **07** |

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