

# GUJARAT TECHNOLOGICAL UNIVERSITY

BE - SEMESTER-III EXAMINATION – SUMMER 2025

Subject Code:3130606

Date:13-06-2025

Subject Name: Geotechnical Engineering

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) Differentiate between Shallow foundation and Deep foundation.	03
	(b) Discuss the factors affecting the permeability of soil.	04
	(c) Derive the relation between following: 1. Water content, Void ratio, Specific Gravity and Degree of saturation. 2. Void ratio and Porosity	07
Q.2	(a) What are the three phase of soil?	03
	(b) Define the terms: Void ratio, Degree of saturation, Bulk mass density, Water content.	04
	(c) Describe the method of liquid limit of soil by Casagrande method.	07
<b>OR</b>		
	(c) Describe plate load test with neat sketches.	07
Q.3	(a) What are the different methods of compaction adopted in the field?	03
	(b) Explain Terzaghi's "Spring analogy" for consolidation of soil.	04
	(c) A soil sample has a liquid limit of 45 %, plastic Limit 22% and flow index of 10 %. Natural water content of soil is 13% so determine (i) Plasticity index. (ii) Liquidity index (iii) Consistency Index. (iv) Toughness index.	07
<b>OR</b>		
Q.3	(a) Differentiate between compaction and consolidation	03
	(b) Define: (i) Permeability (ii) Seepage (iii) Hydraulic Gradient (iv) Critical Hydraulic Gradient	04
	(c) A laboratory compaction test on soil having $G = 2.70$ gave MDD of 1.90 g/cc and a water content of 13%. Determine the degree of saturation, air content and percentage air voids at the maximum dry density. What would be theoretical maximum dry density corresponding to zero air voids at the optimum moisture content.	07
Q.4	(a) Explain pressure bulb.	03
	(b) Explain briefly New-mark's influence chart.	04
	(c) Describe direct shear test. What are the advantages of this test? What are its limitations?	07
<b>OR</b>		
Q.4	(a) Explain modified Mohr-coulomb theory.	03
	(b) Explain factors affecting selection of type of foundation.	04
	(c) Enlist the assumptions of Rankine's theory. Derive the expression for active pressure and passive pressure.	07
Q.5	(a) Enlist different types of slope failures.	03
	(b) Mention the conditions where pile foundation is more suitable than shallow foundation.	04

- (c) A strip footing 2m wide at a depth of 1.2 m in sand. The saturated unit weight of sand is  $19.5 \text{ kN/m}^3$  and unit weight above water table is  $16.8 \text{ kN/m}^3$ , and having angle of shearing resistance is  $35^\circ$ . Determine the Ultimate bearing capacity for the following cases of location of water table: **07**
- i. Water table is 1.2 m below G.L
  - ii. Water table is at G.L itself.
- Use Terzaghi's theory. ( $N_q=41.4$ ,  $N_\gamma=42.4$ ,  $N_c=41.4$ .)

**OR**

- Q.5** (a) Define the following terms: **03**
- I. Foundation
  - II. Bearing Capacity
  - III. Ultimate bearing capacity
- (b) Define stability number. Discuss its utility in the analysis of stability of slopes. **04**
- (c) A 30 cm diameter concrete pile is driven into homogeneous consolidated clay deposit ( $c= 40 \text{ kN/m}^2$ ,  $\alpha=0.7$ ). If the embedded length is 10m , estimate the safe load( F.S.= 2.5). **07**

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