

GUJARAT TECHNOLOGICAL UNIVERSITY
BACHELOR OF ENGINEERING – SEMESTER 4 – EXAMINATION – SUMMER 2026

Subject Code: BE04006021

Date: 25/05/2026

Subject Name: Geotechnical Engineering

Time: 10:30 AM TO 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.**
- 4. Simple and non-programmable scientific calculators are allowed.**

- Q.1**
- (a) State need and scope of geotechnical engineering. **03**
 - (b) Derive relationship between void ratio, porosity, and degree of saturation. **04**
 - (c) Discuss the factors affecting the permeability of soil. **07**
- Q.2**
- (a) Explain advantages and limitations of direct shear test. **03**
 - (b) Describe vane shear test. **04**
 - (c) The stresses on a failure plane in a drained test on a cohesionless soil are as under **07**
Normal stress = 150 kN/m^2 , Shear stress = 60 kN/m^2
Determine the angle of shearing resistance and angle which the failure plane makes with the major principal plane. Also find principal stresses.
- OR
- Q.2**
- (c) An unconfined compression test was conducted on an undisturbed sample of clay. The sample had a diameter of 38 mm and length 76 mm. The load at failure was 50 N and the axial deformation of the sample 10 mm. Determine the undrained shear strength parameters, if the failure plane made an angle of 50° with horizontal. **07**
- Q.3**
- (a) Differentiate between compaction and consolidation. **03**
 - (b) Explain field compaction methods. **04**
 - (c) Explain compaction mechanism and discuss factors affecting compaction with practical significance. **07**
- OR
- Q.3**
- (a) Explain primary consolidation and secondary consolidation. **03**
 - (b) Explain General shear failure, local shear failure and punching shear failure. **04**
 - (c) Explain Terzaghi's "Spring analogy" for consolidation of soil. **07**
- Q.4**
- (a) State assumptions of Boussinesq's Theory. **03**
 - (b) Enlist the assumptions of Rankine's theory. Derive the expression for active pressure and passive pressure. **04**
 - (c) An embankment is inclined at an angle of 40° and its height is 10m. The angle of shearing resistance is 20° and the cohesion is 80 kN/m^2 . The unit weight of soil is 17 kN/m^3 . If Taylor's stability number is 0.06, find factor of safety with respect to cohesion. **07**

OR

Q.4	(a) Enlist different types of slope failures.	03
	(b) Write short note on pressure bulb.	04
	(c) A retaining wall with vertical back and 6.0 m in height supports cohesionless soil up to full heights. It also carries udl of 27 kN/m^2 . If the unit weight of soil is 17.5 kN/m^3 , and angle of internal friction is 30° , calculate pressure intensity at base, total horizontal thrust with its location.	07
Q.5	(a) Define the following term: (a) Alluvial soil (b) Specific gravity (c) Water Content.	03
	(b) Explain sand replacement method to find field density of soil.	04
	(c) Calculate the plasticity index, liquidity index and consistency index of a soil mass for a given data as: Natural water content = 40 %, $W_L = 50$ %, $W_P = 20$ % .	07
OR		
Q.5	(a) Classify piles based on material and explain briefly.	03
	(b) Differentiate between shallow and deep foundations	04
	(c) Discuss factors affecting bearing capacity and suggest improvement methods.	07
