

(3 Hours)

GE - I

N. B.:

- (1) Question No. 1 is compulsory.
- (2) Attempt any three from remaining five questions.
- (3) Figures to the right indicate the full marks.
- (4) Assume any suitable data if not given and justify the same.

- Q.1 (A) Mention the scope of Geotechnical Engineering in the design of foundation and underground structures. Write two to three points about both. [05]
- (B) Prove that energy supplied to soil in standard proctor test is 592.5 kJoule/m^3 . [02]
- (C) Shear strength of soil is a complex property why? Write three points. [03]
- (D) Write two points about aim of one dimensional consolidation test. [02]
- (E) Volume of density bottle is less than pycnometer, why? Write three points. [03]
- (F) Write four use of particle size distribution curve. [03]
- (G) Establish the relationship between porosity, air content and percentage air void. [02]
- Q.2 (A) With usual notations show that: $\gamma = \gamma_d + S_r (\gamma_{sat} - \gamma_d)$. [04]
- (B) Define shrinkage index, volumetric shrinkage, and shrinkage ratio. [06]
- (C) Write source of clay minerals, their types and effects on soil properties. [05]
- (D) A sampling tube of 38 mm internal diameter was used to extract a sample of cohesive soil from a test pit. The length of extracted sample was 102 mm and it had a mass of 220 gram and water content of 18%. Find void ratio, porosity, degree of saturation, and percentage air voids. Take $e = 2.7$. [05]
- Q.3 (A) The difference in values of capillary rise for fine sand and silt was found to be 4.5 m. if the capillary rise in fine sand is 0.5 m, compute the difference in size of voids of two soils. [08]
- (B) A sand stratum is 10 m thick. The water table is 2 m below ground level. The unit weight of sand layer above and below water table are 17 kN/m^3 and 21 kN/m^3 respectively. The capillary rise above water table is 1m. Draw the effective stress, pore pressure and total stress diagram for the sand stratum. [10]
- (C) Quick sand condition is not possible in coarse grained soil, why? [02]
- Q.4 (A) Explain Darcy's law its application in determination of permeability, also explain limitations its use in determination of k. [05]
- (B) The discharge through a pervious soil is 216 cc/day. The flow net shows 5 flow channels, 10 equipotential drops. The head causing the flow is 2 m. Calculate the permeability of the soil. [05]

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- Q.4 (C) A 5 m thick saturated soil stratum has a compression index of 0.25 and coefficient of permeability 3.2×10^{-3} mm/sec. If the void ratio is 1.9 at vertical stress of 0.15 N/mm^2 , compute the void ratio when the vertical stress is increased to 0.2 N/mm^2 . Also calculate settlement due to above stress increase and time required for 50% consolidation. [10]
- Q.5 (A) List the assumptions made in deriving Terzaghi's one dimensional consolidation theory. [05]
- (B) Establish the relationship between σ_1 , σ_3 , c and ϕ . [05]
- (C) Describe the advantages and disadvantages of: Test pits, Hand augers, and Wash boring. [10]
- Q.6 (A) Compare compaction and consolidation. [05]
- (B) The following data relate to a triaxial compression test performed on a soil sample:

Test No.	Cell Pressure	Maximum deviator stress	Pore pressure at maximum deviator stress
1	80 kN/m^2	175 kN/m^2	45 kN/m^2
2	150 kN/m^2	240 kN/m^2	50 kN/m^2
3	210 kN/m^2	300 kN/m^2	60 kN/m^2

Determine the total and effective stress parameters of the soil [10]

- (C) Compare primary valance bond and secondary valance bond. [05]