

Time: 3 Hours

Marks: 80

- 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 suitable data if not given and justify the same.

- Q. 1
- A. Explain the scope of geotechnical engineering in design of earth retaining structures. 05
  - B. Show the energy supplied in light compaction test is 592 Kilo joule per cubic meter. 05
  - C. A lake full of water up to a depth of 10 m and soil below its bottom surface is saturated clay with  $\gamma_{\text{sat}} = 20 \text{ kN/m}^3$  and unit weight of water is  $10 \text{ kN/m}^3$ . Calculate the effective stress at a depth of 5 m below lake bed level. 05
  - D. Explain the validity of Darcy's law for determination of permeability of soil. 05

- Q. 2
- A. Explain the quick sand condition and derive the expression for critical hydraulic gradient. 05
  - B. The bulk unit weight of a soil is  $17 \text{ kN/m}^3$  and water content is 12%. Calculate the void ratio of soil if  $G = 2.65$   $\gamma_w = 9.81 \text{ kN/m}^3$ . 05
  - C. A soil sample has a liquid limit of 20 % and plastic limit of 12 %. The following data are also available from sieve analysis: 10

Sieve size	% passing
4.75 mm	90
0.425 mm	85
0.075 mm	38

Classify the soil according to IS classification system

- Q. 3
- A. In a unsaturated specimen of clay has a volume of 19.5 cc and mass of 31 gm. On oven drying the mass reduces to 18 gm. The volume of dry specimen as determined by displacement of mercury is 10 cc. Determine shrinkage limit, specific gravity, shrinkage ratio and volumetric shrinkage 10
  - B. A dry soil has a porosity of 25%. Find how much water is required to saturate  $1 \text{ m}^3$  of this soil. 05
  - C. Explain the methods used to determine the in-situ permeability 05
- Q. 4
- A. Explain the characteristics of flow net. 05
  - B. Explain the factors affecting the compaction. 05

- C. In a falling head permeability test the length and area of cross section of soil specimen are 0.17 m and  $21.8 \times 10^{-4} \text{ m}^2$  respectively. Calculate the time required for the head to drop from 0.25 m to 0.10 m. the area of cross section of stand pipe is  $0.0002 \text{ m}^2$ . The sample has three layers with permeabilities 0.00003 m/sec for first 0.06 m, 0.00004 m/sec for second 0.06 m and 0.00006 m/sec for third 0.05 m thickness. Assume the flow is taking place perpendicular to the bedding plane. 10
- Q. 5 A. Calculate the equivalent permeability in horizontal and vertical direction of soil deposit consisting of three Layers 150 cm, 180 cm and 200 cm thick with Permeabilities  $10^{-5}$ ,  $10^{-7}$  and  $10^{-9}$  m/sec respectively. 05
- B.  $1000 \text{ m}^3$  of earth fill is to be constructed. How many cubic meters of soil is to be excavated from a borrow pit in which the void ratio is 0.95, if the void ratio of earth fill is to be 0.7? 05
- C. Explain different methods of boring for soil exploration. Cover explanation point wise duly supported by diagrams. 10
- Q. 6 A. A fully saturated sample of clay was found to have mass specific gravity of 1.91 and water content of 29%. The soil sample was oven-dried and its mass specific gravity was found to reduce to 1.83. Calculate the shrinkage limit of soil. 10
- B. Using the given data, classify the following soils as per IS 1498. 10
- (a) Liquid limit = 40% ; Plastic limit = 22% [02 Marks]
- (b) Liquid limit = 20% ; Plastic limit = 14% [03 Marks]
- (c) passing  $75 \mu$  sieve : 10% [05 Marks]
- Passing  $4.75 \mu$  mm sieve : 70%
- $C_u = 8$ ,  $C_c = 2.8$ , and  $I_p$  (plasticity index) = 4%

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