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**Question Paper Code : 30100**

B.E./B.Tech. DEGREE EXAMINATIONS, APRIL/MAY 2023.

Fourth Semester

Civil Engineering

CE 3404 — SOIL MECHANICS

(Regulations 2021)

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Time : Three hours

Maximum : 100 marks

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. How do you determine the plasticity index of soil?
2. A soil has a bulk density of  $22 \text{ kN/m}^3$  and water content is 10%. Find dry density of soil.
3. Define Darcy's law.
4. What are the factors affecting permeability?
5. Determine the time factor if degree of consolidation is 85%.
6. List out the components of settlement.
7. What are the tests available for determining the shear strength of soil?
8. Given that the unconfined compressive strength of soil is  $160 \text{ kg/cm}^2$ , determine the cohesion and shear strength.
9. What are the types of slope failure?
10. Differentiate finite slope and infinite slope.

## PART B — (5 × 13 = 65 marks)

11. (a) The mass of wet soil when compacted in a mould was 25kN. The water content of the soil was 12%. If the volume of the mould was 1100 cc. Determine,
- Dry unit weight
  - Void Ratio
  - Degree of saturation and
  - Percent air voids. Take  $G = 2.68$ .

Or

- (b) A soil sample has a porosity of 45%. The specific gravity of solids 2.70, Calculate,
- Void ratio
  - Dry density
  - Unit weight of the soil, if 50% saturated
  - Unit weight of the soil, if completely saturated.
12. (a) Compute the total pressure, effective pressure and pore water pressure at a depth of 20 m below the bottom of a lake 6 m deep. The bottom of lake consists of soft clay with a thickness of more than 20m. The average water content of the clay is 40% and specific gravity of the soil may be assumed to be 2.65.

Or

- (b) Explain in detail the laboratory experiment to determine coefficient of permeability for coarse grained soil with neat sketch. Also derive the suitable governing equation.
13. (a) A water tank is supported by a ring foundation having outer diameter of 10 m and inner diameter of 7.5 m. The ring foundation transmits a uniform load intensity of 160 kN/m<sup>2</sup>. Compute the vertical stress induced at depth of 4 m, below the centre of ring foundation, using Boussinesque analysis.

Or

- (b) In a consolidation test, the void ratio of the specimen which was 1.05 under the effective pressure of 214 kN/m<sup>2</sup>, changed to 0.995 when the pressure was increased to 430 kN/m<sup>2</sup>. Calculate the (i) co-efficient of compressibility (ii) Compression index (iii) co-efficient of volume change.

14. (a) A vane shear 8cm in diameter and 12cm in length was used to measure shear strength of the clay. If a torque of 650 Nm was required in natural state and 1250 Nm in remoulded state, determine shear strength in both the cases.

Or

- (b) Explain in detail the how shear strength of a soil is determined by unconfined compressive strength. Explain with neat sketch.
15. (a) Write down the procedure for determining the factor of safety of a given slope by friction circle method.

Or

- (b) In a sloping terrain, it was found that the soil is clayey and weak in nature, suggest any four slope protection methods to stabilize the slope.

PART C — (1 × 15 = 15 marks)

16. (a) The following data were obtained in a direct shear test.  
 Normal pressure = 25 kN/m<sup>2</sup>, tangential pressure = 20 kN/m<sup>2</sup>, Angle of internal friction = 20°, cohesion = 10kN/m<sup>2</sup>.  
 Represent the data by Mohr's Circle and compute the principal stresses and the direction of the principal planes.

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- (b) A saturated soil has a compression index of 0.3. Its void ratio at a stress of 12 kN/m<sup>2</sup> is 2 and its permeability is  $3.5 \times 10^{-7}$  mm/s. Compute:  
 (i) Change in void ratio if the stress is increased to 20 kN/m<sup>2</sup>;  
 (ii) Settlement in if the soil stratum is 5 m thick; and  
 (iii) Time required for 40% consolidation if drainage is one-way.