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Reg. No. : ☐☐☐☐☐☐☐☐☐☐☐☐

Question Paper Code : **30100**

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

Fourth Semester

Civil Engineering

CE 3404 — SOIL MECHANICS

(Regulations 2021)

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 kN/m³ 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 kg/cm², 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,

    (i)   Dry unit weight

    (ii)   Void Ratio

    (iii) Degree of saturation and

    (iv) 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,

    (i)   Void ratio

    (ii)   Dry density

    (iii) Unit weight of the soil, if 50% saturated

    (iv) 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/m². 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/m², changed to 0.995 when the pressure was increased to 430 kN/m². 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/m², tangential pressure = 20 kN/m², Angle of internal friction = 20°, cohesion = 10kN/m².

Represent the data by Mohr's Circle and compute the principal stresses and the direction of the principal planes.

Or

(b) A saturated soil has a compression index of 0.3. Its void ratio at a stress of 12 kN/m² is 2 and its permeability is 3.5×10^{-7} mm/s. Compute:

    (i)   Change in void ratio if the stress is increased to 20 kN/m²;

    (ii)   Settlement in if the soil stratum is 5 m thick; and

    (iii) Time required for 40% consolidation if drainage is one-way.

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