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**Question Paper Code: 34102**

B.E. / B.Tech. DEGREE EXAMINATION, APRIL 2019

Fourth Semester

Civil Engineering

01UCE402 – SOIL MECHANICS

(Regulation 2013)

Duration: Three hours

Maximum: 100 Marks

(Nessam chart and data may be permitted)

Answer ALL Questions.

PART A - (10 x 2 = 20 Marks)

1. What is shrinkage ratio?
2. Classify the soil with following properties as per BIS
  - Passing 75 $\mu$  sieve = 10%
  - Passing 4.75mm sieve = 70%
  - Uniform Co-efficient = 8
  - Co-efficient of curvature = 2.8
  - Plasticity index = 4
3. Mention the two field methods for determining the permeability of soils.
4. Express the relation between discharge velocity and seepage velocity.
5. Differentiate compaction and consolidation.
6. Find the intensity of vertical stress at a point 6m below the vertical load of 30 kN.
7. How liquefaction of sands can be prevented?
8. State Mohr's coulomb theory.
9. Distinguish finite and infinite slopes.
10. Sketch the different types of slope failures.

PART - B (5 x 16 = 80 Marks)

11. (a) (i) Prove the relation  $Se = wG$ , where  $S$ =degree of saturation,  $e$ =void ratio,  $w$ =water content,  $G$ = specific gravity. (8)

(ii) The following properties were determined for two soils  $A$  and  $B$ :

	Soil A	Soil B
Water content	37%	25%
Liquid limit	61%	35%
Plastic limit	25%	20%
Specific gravity of soil solids	2.72	2.68
Degree of saturation	100%	100%

Which of these soils:

1. contain more clay particles
2. has a greater saturated unit weight
3. has a greater dry unit weight
4. has a greater void ratio

Answers should be supported by computations. (8)

Or

(b) Explain the factors affecting compaction of soils. (16)

12. (a) (i) A saturated sand layer over a clay stratum is 5m in depth. The water is 1.5m below ground level. If the bulk density of saturated sand is  $19.66 \text{ kN/m}^3$ , calculate the effective and neutral pressure on the top of the clay layer. (8)

(ii) Derive the equation to determine the value  $c_o$  – efficient of permeability ‘ $K$ ’ from a falling Head permeability test in detail. (8)

Or

(b) (i) What are the different field methods to determine the permeability of soil? Discuss briefly their merits and demerits and special applications? (8)

(ii) Give the applications of flow net. (8)

13. (a) (i) A reinforced concrete water tank of size 6m x 6m and resting on ground surface carries a uniformly distributed load of  $200\text{kN/m}^2$ . Estimate the maximum pressure at a depth of 12 meters vertically below the centre of the base. (8)
- (ii) Explain Terzaghi's theory of one dimensional consolidation. (8)

Or

- (b) (i) A clay layer, whose total settlement under a given load is expected to be  $250\text{mm}$ , settles by  $50\text{mm}$  in 15 days after the application of a load increment. How many days will be required for it to reach a settlement of  $125\text{mm}$ . How much settlement will occur in 300 days? The layer has double drainage. (8)
- (ii) A 10m thick clay layer settles by  $80\text{mm}$  in 2 years under single drainage condition. The coefficient of consolidation is  $5 \times 10^{-3} \text{ cm}^2/\text{s}$ . Calculate the ultimate consolidated settlement and find how long it will take to undergo 90% of this settlement. (8)

14. (a) (i) A sample of cohesionless soil in a direct shear test fails under a shear stress of  $170 \text{ kN/m}^2$  when the normal stress is  $200 \text{ kN/m}^2$ . Find the angle of shearing resistance and the major principal stress at failure. (8)
- (ii) Describe triaxial compression test. (8)

Or

- (b) Explain the procedure involved in the tri-axial compression test with neat sketch. (16)

15. (a) Indicate how the stability of a slope is affected by seepage of water. (16)

Or

- (b) (i) A canal with a depth of  $5\text{m}$  has banks with slope 1:1. The properties of soil are: Cohesion  $=20\text{kN/m}^2$ , Angle of internal friction ( $\Phi$ )  $=15^\circ$ ,  $e=0.7$ ,  $G=2.6$ . Calculate factor of safety with respect to cohesion when (a) canal runs full (b) it is suddenly and completely emptied. (8)
- (ii) Write a note on slope protection measures? (8)

