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Question Paper Code : 57161

B.E./B.Tech. DEGREE EXAMINATION, MAY/JUNE 2016

Fourth Semester

Civil Engineering

CE 6405 – SOIL MECHANICS

(Regulations 2013)

Time : Three Hours

Maximum : 100 Marks

Answer ALL questions.

PART – A (10 × 2 = 20 Marks)

1. Define Air content and percentage Air content in soil.
2. Derive the relation between void ratio and porosity.
3. Define Critical Hydraulic Gradient.
4. What are the factors that affect hydraulic conductivity ?
5. What are the stages of consolidation ?
6. Define Stress Isobar or pressure bulb.
7. Give the Coulomb's shear strength equation and list the shear strength parameters.
8. Define stress path.
9. What are the factors leading to the failure of slopes ?
10. What are the three forces acting in circular failure while analyses through friction circle method ?

PART – B (5 × 16 = 80 Marks)

11. (a) (i) In an earth dam under construction, the bulk unit weight is 16.5 kN/m^3 at water content 11%. If the water content has to be increased to 15%, compute the quantity of water to be added per cu.m of soil. Assume no change in void ratio. Determine the degree of saturation at this water content. Take $G = 2.7$. (12)
- (ii) List the factors that affect compaction of soil. (4)

OR

- (b) In its natural condition, a soil sample has a mass of 22.9 N and a volume of $1.15 \times 10^{-3} \text{ m}^3$. After being completely dried in the oven sample weighs 20.35 N. Find bulk density, water content, void ratio, porosity, degree of saturation, air content, dry density and percentage air voids. (16)

12. (a) (i) For a homogeneous earth dam of 52 m height and 2 m free board, the flow net has 22 potential drops and 5 flow channels. Calculate the discharge per metre length of the dam, given $k = 22 \times 10^{-6} \text{ m/sec}$ and exit hydraulic gradient. (8)
- (ii) List the characteristics of flow nets. (8)

OR

- (b) (i) The bed of a river 5m deep consists of sand (saturated unit weight of sand is 19.5 kN/m^3). Calculate the effective vertical stress 5 m below the surface of sand. (8)
- (ii) Define (i) Total Stress (ii) Neutral Stress and (iii) Effective Stress. Write also about their significance. (8)

13. (a) (i) Find intensity of vertical pressure at a point 3 m directly below 25 kN point load acting on a horizontal ground surface. What will be the vertical pressure at a point 2 m horizontally away from the axis of loading and at same depth of 3 ? Use Boussinesq's equation. (10)
- (ii) List the Boussinesq's Theory Assumptions and limitations. (6)

OR

(b) (i) List the different components of settlement ? Explain their occurrence with respect to the change in soil systems. (6)

(ii) 20 mm thick undisturbed sample of saturated clay is tested in laboratory with drainage allowed through top and bottom. Sample reaches 50% consolidation in 35 minutes. If clay layer from which sample was obtained is 3.0 m thick and is free to drain through top and bottom surfaces, calculate the time required for same degree of consolidation in the field. What is the time required if the drainage in the field is only through the top ? (10)

14. (a) Explain the tri-axial shear tests based on drainage and their applicability. (16)

OR

(b) (i) What is the shear strength in terms of effective stress on a plane within a saturated soil mass at a point where the total normal stress is 295 kN/m^2 and the pore water pressure is 120 kN/m^2 ? The effective stress parameters for the soil are $c' = 12 \text{ kN/m}^2$ and $\phi' = 30^\circ$. (8)

(ii) Write the advantages, disadvantages and limitations of direct shear test. (8)

15. (a) (i) Explain different slope protection measures. (10)

(ii) Differentiate between finite and infinite slope. (6)

OR

(b) Explain the Fellenius Method of slices method of finding slope stability. (16)