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Question Paper Code: 50145

B.E. / B.Tech. DEGREE EXAMINATION, MAY 2017

Fourth Semester

Civil Engineering

15UCE405 - SOIL MECHANICS

(Regulation 2015)

Duration: Three hours

Maximum: 100 Marks

Answer ALL Questions

PART A - (10 x 1 = 10 Marks)

- The ratio of the unit weight of the soil solid to that of water is called
 - Void ratio
 - Porosity
 - Specific gravity
 - Degree of saturation
- If the pores of a soil are completely full of air only, the soil is said to be
 - Wet soil
 - Dry soil
 - fully saturated soil
 - partially saturated
- Quick sand is a
 - moist sand containing small particle
 - condition which occurs in coarse sand
 - condition in which a cohesionless soil losses all it strength because of upward flow of water
 - none of these
- A flow net may be utilized for the determination of
 - exit gradient
 - seepage
 - hydrostatic pressure
 - all the above

5. The coefficient of compressibility of soil, is the ratio of
 - (a) strain to stress
 - (b) stress to settlement
 - (c) rate of loading to that of settlement
 - (d) stress to strain

6. The ratio of settlement at any time 't' to the final settlement, is known as
 - (a) coefficient of consolidation
 - (b) degree of consolidation
 - (c) consolidation of undisturbed soil
 - (d) consolidation index

7. The angle that Coulomb's failure envelope makes with horizontal is called
 - (a) cohesion
 - (b) angle of internal friction
 - (c) angle of repose
 - (d) none of these

8. Shear strength of a soil is a unique function of
 - (a) effective stress only
 - (b) total stress only
 - (c) both effective and total stress
 - (d) none of these

9. Bishop's method of stability analysis
 - (a) is more conservative
 - (b) neglects the effects of forces acting on the sides of the slices
 - (c) assumes the slip surfaces as an arc of a circle
 - (d) all the above

10. If the failure of a finite slope occurs through the toe, it is known as
 - (a) slope failure
 - (b) base failure
 - (c) toe failure
 - (d) face failure

PART - B (5 x 2 = 10 Marks)

11. What is the relationship between unit weight and density?
12. For a given soil, the coefficient of permeability increases with an increase in void ratio. Why?
13. Distinguish between compaction and consolidation.
14. If angle of internal pressure of a soil is 36° . Find the angle made by failure plane with respect to minor principle plane?

15. How do you define failure in soils?

PART - C (5 x 16 = 80 Marks)

16. (a) A natural soil deposit has a bulk unit weight of 18.44 KN/m^3 , water content of 5%. Calculate the amount of water required to be added to 1 m^3 of soil to raise the water content to 15%. Assume the void ratio to remain constant. What will then be the degree of saturation? Assume $G = 2.67$. (16)

Or

(b) Explain the Indian Standard method of classification for soil system. (16)

17. (a) Explain and discuss the merits and demerits of different methods of sketching flow nets. (16)

Or

(b) A rectangular area $2\text{m} \times 4\text{m}$ carries a uniform load of 80 KN/m^2 at the ground surface find the vertical pressures at 5m below the centre and corner of the loaded area. (16)

18. (a) Explain with a neat sketch the Terzaghi's one dimensional consolidation theory. (16)

Or

(b) (i) What are the factors affecting compaction? Explain in detail. (8)

(ii) What are the different methods of compaction adopted in the field? Brief it. (8)

19. (a) Two identical specimens, 4 cm in diameter and 8 cm high, of partly saturated compacted soil is tested in a triaxial cell under un-drained conditions. The first specimen failed at an additional axial load (i.e. deviator load) of 720 N under a cell pressure of 100 kN/m^2 . The second specimen failed at an additional axial load of 915 N under a cell pressure of 200 kN/m^2 . The increase in volume of the first specimen at failure is 1.2 ml and it shortens by 0.6 cm, at failure. The increase in volume of the second specimen at failure is 1.6 ml, and it shortens by 0.8 cm at failure. Determine the value of apparent cohesion and the angle of shearing resistance (a) analytically, (b) graphically by Mohr's circle. (16)

Or

- (b) In a direct shear test conducted on a dense sand, the sample fails at a shear stress of 75kN/m^2 , when the normal stress was held constant at 100 kN/m^2 . Draw the mohr circle for the failure condition and determine (i) the angle of shearing resistance (ii) the orientation of the major and minor principal planes and stresses acting on them and (iii) the orientation of the plane of maximum shear stress. If a specimen of the soil were to be tested in a tri-axial shear test under CD conditions at a cell pressure of 125 kN/m^2 , at what axial stress would the sample fail? (16)
20. (a) A proposed cutting in a homogeneous cohesive soil will have a slope angle of 25° and will be 8.0 m deep. Using Taylor's stability chart, determine the factor of safety against shear failure in respect of the following soils; (i) $C_u = 45\text{ kN/m}^2$; $\phi_u = 0$; $\gamma = 19\text{ kN/m}^3$; D is large. (ii) $C_u = 45\text{ kN/m}^2$; $\phi_u = 0$; $\gamma = 19\text{ kN/m}^3$; the cohesive layer overlies a hard layer of shale, present at a depth of 12m . (iii) $C_u = 25\text{ kN/m}^2$; $\phi_u = 15^\circ$; $\gamma = 18.5\text{ kN/m}^3$. (16)

Or

- (b) How a slope is analyzed using friction circle method? Drive an expression for the factor of safety. (16)
