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B.E./B.Tech. DEGREE EXAMINATION, MAY/JUNE 2006.

Fourth Semester

Civil Engineering

CE 1251 – MECHANICS OF SOILS

(Common to B.E. (Part-Time) Third Semester)

(Regulation 2004)

Time : Three hours Maximum : 100 marks

Answer ALL questions.

PART A — ($10 \times 2 = 20$ marks)

1. Differentiate between density and unit weight of soil.

2. What do you understand by consistency of soil?

3. For a given soil, the coefficient of permeability increases with an increase in void ratio. Why?

4. What is effective stress principle?

5. A loose uniform sand with rounded grains has an effective grain size D_{10} equal to 0.3 mm. Estimate the coefficient of permeability.

6. Mention the assumptions of Boussinesq's solution.

7. What is stress path?

8. How liquefaction of sands can be prevented?

9. Name the different types of slope failures?

10. What are the limitations of Culmann's method of stability analysis?

11. (i) What are the different components of settlement? Explain in brief. (6)

(ii) A soft normally consolidated clay layer is 50m thick with a moisture content of 45%. The clay has a saturated unit weight of 20 kN/m^3, a particle specific gravity of 2.7 and a liquid limit 32%. A foundation load will subject the center of layer to a vertical stress increase of 70 kPa. Ground water level is at the surface of the clay. Estimate (1) the initial and final effective stresses at the center of the layer (2) the approximate value of the compression index (Cc) (3) the consolidation settlement of the foundation if the initial effective stress at the center of the soils is 100 kPa. (10)

12. (a) A sample of sand above water table was found to have a natural moisture content of 15% and a unit weight of 18.84 kN/m^3. Laboratory tests on a dried sample indicated values $e_{min} = 0.5$ and $e_{max} = 0.8$ for the densest and loosest state respectively. Compute the degree of saturation and the relative density. Assume $G = 2.65$. (16)

Or

(b) The following data are available in connection with the construction of an embankment.

(i) Soil from borrow pit: Natural density 17.6 kN/m^3; Natural water content= 12%.

(ii) Soil after compaction: Density = 20 kN/m^3; water content = 18% Estimate (1) the quantity soil to be excavated from the borrow pit and (2) the amount of water to be added, for every 100m^3 of compacted soil of the embankment. (16)

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

Or

(b) A sand deposit is 10m thick and overlies a bed of soft clay. The ground water table is 3m below the ground surface. If the sand above the ground water table has a degree of saturation of 45%, plot the diagram showing the variation of the total stress, pore water pressure and the effective stress. The void ratio of the sand is 0.70. Take G = 2.65. (16)

14. (a) In a formation of cohesion less soil, the water table is at a depth of 3m. The degree of saturation may be taken as 0.5 and the average void ratio 0.5; grain specific gravity 2.7; angle of internal friction = 30°. Calculate the potential shear strength on a horizontal plane at a depth of 2.5m below the surface. Also, calculate the modified value of the shear strength if the water table reaches the ground surface. (16)

Or

(b) A cylindrical specimen of dry sand was tested in a triaxial test. Failure occurred under a cell pressure of 1.2 kg/cm^2 and at a deviator stress of 4.0 kg/cm^2.

(i) What is the angle of shearing resistance of the soil?

(ii) What were the normal and shear stresses on the failure plane?

(iii) What angle did the failure plane make with the minor principal plane?

(iv) What was the maximum shear stress on any plane in the specimen at the instant of failure and how was the plane, in question be oriented with the major principle plane? (16)

15. (a) What will be the factors of safety with respect to average shearing strength, cohesion and internal friction of a soil, for which the shear strength parameters obtained from the laboratory tests are $c = 32$ kN/m^2 and $\phi = 18°$; the expected parameters of mobilised shearing resistance are $c = 21$ kN/m^2 and $\phi m = 13°$ and the average effective pressure on the failure plane is 110 kN/m^2? Also for the same value of mobilised shearing resistance determine the following.

(i) Factor of safety with respect to height

(ii) Factor of safety with respect to friction when that with respect to cohesion is unity

(iii) Factor of safety with respect to strength. (16)

Or

(b) What is stability number? Discuss the various methods for improving the stability of slope. (16)