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(2064)

14628

B. Tech 4th Semester Examination

Geotechnical Engineering-I (N.S.)

CE-222

Time : 3 Hours

Max. Marks : 100

*The candidates shall limit their answers precisely within the answer-book (40 pages) issued to them and no supplementary/continuation sheet will be issued.*

**Note :** Attempt five questions selecting one question from each section A, B, C and D. Question 9 is compulsory. All questions carry equal marks. Non-programmable calculator is allowed.

**SECTION - A**

1. (a) Discuss how various types of soils are formed giving clear illustrations.
- (b) Sketch the grain size distribution curves for well graded, uniformly graded and gap graded soils. Define and explain with sketch uniformity coefficient and coefficient of curvature. (10+10=20)

OR

2. (a) Using three phase soil system show that the degree of saturation  $S_r$  in terms of bulk unit weight  $\gamma$ , water content  $w$ , specific gravity of soil  $G$  and unit weight of water  $\gamma_w$  is given by the expression:

$$S_r = w(\gamma_w / (\gamma - 1) - 1/G)$$

- (b) Calculate plastic limit and plasticity index of a soil sample from following data:

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[P.T.O.]

Mass of 3 mm crumbles soil threads = 17.1 g

Mass of oven dried soil threads = 14.82 g, Liquid limit of soil sample = 35.2 %

- (c) For soil classification, test results obtained on soil sample are:  $w_L = 54\%$ ,  $w_p = 21\%$

Size (mm)	1.0	0.075	0.060	0.005	0.002
Percent finer	98	71	69	31	19

Determine the percentage of sand, silt & clay and classify the soil as per I.S. 1498. (10+5+5=20)

### SECTION - B

3. (a) Derive an expression for the coefficient of permeability of stratified soils.
- (b) An earth dam is built on an impervious foundation with a horizontal filter under the down stream slope. The horizontal and vertical permeabilities of the soil in the earth dam are  $4 \times 10^{-3}$  and  $1 \times 10^{-3}$  cm/sec. The full reservoir level is 15 metres above the down stream filter. A flow net, constructed for transformed section of the dam, consists of 4 flow channels and 15 equipotential drops. Estimate seepage loss per metre length of the dam. (10+10=20)

OR

4. (a) Explain how Newmark's chart is used for determining the vertical stress at a point due to a loaded area.
- (b) A circular area of 10 m radius on the surface of an elastic mass of great extent carries a uniformly distributed load of  $150\text{kN/m}^2$ . Determine the intensity of vertical pressure at a point 10 m beneath the centre of the circular loaded area. (10+10=20)

**SECTION - C**

5. (a) Discuss different methods of field compaction of soils. Also explain the suitability of different compaction equipments.
- (b) A laboratory compaction test on a soil having specific gravity 2.70 gave maximum dry density of  $1.86 \text{ g/cm}^3$  and optimum moisture content of 15 %. Determine the degree of saturation, air content and percentage air voids at maximum dry density. Also find theoretical maximum dry density for zero air voids at OMC. (10+10=20)

OR

6. (a) Explain Terzaghi's theory of one dimensional consolidation.
- (b) A clay layer whose total settlement under a given loading is expected to be 12 cm settles 3 cm at the end of 1 month after the application of load increment. How many months will be required to reach a settlement of 6 cm? How much will be the settlement after 10 months? (10+10=20)

**SECTION - D**

7. (a) List various methods of finding shear strength of soils. Discuss their relative merits and demerits.
- (b) An embankment 6 m high is made up of soil whose effective stress parameters are  $c' = 45 \text{ kN/m}^2$  and  $\phi' = 18^\circ$  and  $\gamma = 16.8 \text{ kN/m}^3$ . The pore pressure parameters as found from triaxial tests are  $A = 0.50$ . and  $B = 0.96$ . Find the shear strength of the soil at the base of embankment just after the fill has been raised from 0m to 0.10m. Consider pore pressure dissipation during this construction stage to be negligible and the lateral pressure at any point to be one-half of the vertical pressure. (10+10=20)

**[P.T.O.]**

OR

8. (a) Discuss in detail how cement is used for the stabilization of soils.
- (b) Explain the technique of stabilization of soil utilizing bitumen. (10+10=20)

**Section - E (Compulsory)**

9. (a) Define and explain void ratio and porosity.
- (b) What is honeycomb structure of soil? Explain.
- (c) Define and explain flow index.
- (d) List various factors affecting permeability.
- (e) Define and explain total stress and effective stress in a submerged soil.
- (f) Give contact pressure distributions for various soils under rigid footing.
- (g) What is zero air void line? Explain.
- (h) Explain secondary consolidation.
- (i) Give disadvantages of direct shear test.
- (j) Explain stabilization by heating. (10×2=20)