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Question Paper Code : 21248

B.E./B.Tech. DEGREE EXAMINATION, NOVEMBER/DECEMBER 2015.

Fourth Semester

Civil Engineering

CE 2251/CE 42/CE 1251/080100018/10111 CE 402 — SOIL MECHANICS

(Regulations 2008/2010)

(Common to PTCE 2251/10111 CE 402 – Soil Mechanics for B.E. (Part-Time) Third Semester – Civil Engineering – Regulations 2009/2010)

Time : Three hours

Maximum : 100 marks

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. In a saturated soil mass, if water content is 24% and specific gravity of soil is 2.64, estimate porosity.
2. List out the factors affecting compaction.
3. Compare seepage velocity with superficial velocity.
4. Define quick sand condition.
5. What are the components of settlement?
6. State the assumptions made in Terzaghi's one dimensional consolidation theory.
7. Define stress path.
8. Enumerate the limitations of Box shear test.
9. What is tension crack?
10. Differentiate infinite slope and finite slope.

PART B — (5 × 16 = 80 marks)

11. (a) In an undisturbed soil sampling, 903 g of wet soil occupies a volume of 425 cc. On oven drying, the weight of soil reduced to 802 g. If the specific gravity of soil is 2.64, determine,
- (i) Bulk unit weight
 - (ii) Dry unit weight
 - (iii) Saturated unit weight
 - (iv) Submerged unit weight
 - (v) Water content
 - (vi) Void ratio
 - (vii) Porosity and
 - (viii) Degree of saturation.

Or

- (b) The following are results of standard proctor compaction test performed on a sample of soil.

Water content (%) :	5	10	15	20	25	30
Weight of wet soil (g) :	1750	2000	2100	2200	2160	2150

- (i) Plot the water content-dry density curve and obtain the optimum water content and maximum dry density. (6)
 - (ii) Calculate the water content necessary to saturate the sample completely at its maximum dry density, assuming no change in the volume. Take $G = 2.65$ and Volume of compaction mould as 1000 cc. (4)
 - (iii) Plot zero air void line. (6)
12. (a) With the help of neat sketches and usual notations, derive expressions for the following. State the assumptions made in each of them
- (i) Coefficient of permeability by constant head method (5)
 - (ii) Coefficient of permeability by variable head method. (6)
 - (iii) Average coefficient of permeability of layered soil system, when flow takes place perpendicular to the bedding plane. (5)

Or

- (b) Critically discuss different methods of determining flow nets.

13. (a) A 3 m thick clay layer beneath a building is overlain by a permeable stratum and is underlain by an impervious rock. The coefficient of consolidation of the clay was found to be 0.025 cm²/minute. The final expected settlement for the layer is 8.0 cm. Determine

- (i) How much time will it take for 80% of total settlement to take place,
- (ii) The time required for a settlement of 2.5 cm to occur.
- (iii) Compute the settlement that would occur in 365 days

<i>U</i> in %	10	20	30	40	50	60	70	80	90
<i>T_v</i> :	0.08	0.031	0.071	0.126	0.196	0.287	0.403	0.567	0.848

Or

(b) A rectangular footing of size 3.0 m × 5.0 m subjected to an external uniformly distributed load of 125 kN/m² has been located at the surface of a homogeneous soil mass. Determine the increase in the intensity of vertical stress at 2.50 m depth exactly below the centre and under any one corner by

- (i) Boussinesq's method
- (ii) Equivalent point load method

14. (a) In a Triaxial test, prove that $\sigma_1 = \sigma_3 * N\phi + 2c\sqrt{N\phi}$, where $N\phi = \frac{1 + \sin \phi}{1 - \sin \phi}$ and using the above expression, determine the shear parameters of the soil for the following observations obtained from triaxial compression test conducted on soil sample of 38 mm diameter and 76 mm long.

Cell pressure in kN/m² : 225 450 675

Deviator stress in kN/m² : 450 675 900

Or

(b) Derive an expression for shear strength in a Vane shear test. Using the expression, determine the cohesion of clay in the natural and remoulded states sheared using 10 cm long and 8 cm diameter vane. The natural soil was failed at a torque of 45 N-m and remoulded soil was failed at a torque of 18 N-m. Also calculate sensitivity of clay.

15. (a) Write explanatory note on :

- (i) Taylor's stability number (5)
- (ii) Stability of infinite slope (5)
- (iii) Stability of slopes of an earthen dam. (6)

Or

(b) Discuss in detail about different modes of finite slope failure and different methods of analyzing factor of safety of finite slopes.