

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

Fourth Semester

Civil Engineering

CE 240 - SOIL MECHANICS

Time : Three hours

Maximum : 100 marks

Answer ALL questions.

Assume relevant data, if necessary.

PART A - (10 × 2 = 20 marks)

1. List the various corrections that are required for a hydrometer reading. How are these corrections applied?
2. What do you understand by consistency of soil? Indicate its significance.
3. Find the capillary rise in a sandy soil which has a void ratio of 0.65 and the effective size of particle is 0.07 mm. Take  $C = 0.1 \text{ cm}^2$ .
4. A deposit of fine sand has a void ratio of 0.54 and the specific gravity of solid particles is 2.67. Compute the safe exit gradient, with a factor of safety of 4.
5. Define the following terms :  
Coefficient of compressibility, Compression index.
6. If the entire semi-infinite soil mass is loaded with a load intensity of  $q$  at the surface, the vertical stress at any depth is equal to  $q$ . How?
7. Differentiate between stress-controlled and the strain-controlled tests. Which test is used for soil?
8. State True or False. Give Reasoning.
  - (a) The pore pressure parameter  $B$  is equal to unity for saturated soils.
  - (b) Lime stabilization is suitable for Coarse grained soil.
9. What is mechanical stabilisation? What are the factors that affect the mechanical stability of a mixed soil?
10. List the various methods for improving the stability slopes.

No 2

11. (i) Derive a relationship between the principal stresses at failure using Mohr-Coulomb failure criterion. (8)

(ii) A series of shear test was performed on a soil. Each test was carried out until the soil sample sheared and the principal stresses for test are as follows :

$\sigma_3$ (kN/m <sup>2</sup> )	300	400	500
$\sigma_1$ (kN/m <sup>2</sup> )	875	1160	1460

Plot the Mohr circle of stress and determine the strength envelope and angle of internal friction of the soil. (8)

12. (a) Discuss the method of checking stability of an infinite slope in a  $C-\phi$  soil. Deduce the factor of safety expression for cohesionless soil. (8 + 8)

Or

(b) Discuss the friction circle method for the stability analysis of slopes. What are its advantages over conventional Swedish circle method. (8 + 8)

13. (a) (i) Enumerate how the Newmark chart is constructed to determine the increment of stress due to an applied load.

(ii) Bring out the equation that is used to estimate the one dimensional consolidation settlement from  $e-\log p$  relationship. (8 + 8)

Or

(b) (i) Describe the cross sectional view of one dimensional consolidation ring with its parts. Enumerate the procedure of the test. (8)

(ii) Derive the equation to determine the stress increment due to udl over circularly loaded area from point load equation. (8)

14. (a) A sand deposit is 10 m thick and overlies a bed of soft clay. The ground water table is 3 m 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 0.7. Take  $G_s = 2.65$ . (16)

Or

(b) A 10 m thick layer of silty clay ( $\gamma = 18.6 \text{ kN/m}^3$ ) overlies a gravel layer. The gravel is under an artesian pressure of 12.5 m. It is proposed to excavate a foundation trench 2 m deep. Determine the factor of safety against heaving. What would be the factor of safety against heaving when a uniform pressure of 98.1 kN/m<sup>2</sup> is applied to the footing constructed in the above trench.

11. (a) Define the following terms:

- (i) Liquidity index and consistency index
- (ii) Flow index and toughness index
- (iii) Plasticity and consistency
- (iv) Activity and nonactivity.

Or

(b) Prove that the particle diameter and the terminal velocity of particle are related as  $v = 9020 D^2$ ,  $v$  = velocity in cm/sec,  $D$  = Diameter in cm.

Clearly state the various assumptions made.

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