Ref. No. Ex/CE/PC/B/T/223/2024

B.E. CIVIL ENGINEERING 2nd Year; 2nd Semester EXAMINATION 2024

Geotechnical Engineering - I

Total Time: Three Hours | Full Marks 100 (Part I: 50 + Part II: 50)

*Use a separate Answer-Script for each part. Assume any data, **with proper justification**, if required.*

Part I (50 Marks)

Attempt All :

1 (CO3) (a) The experimental data obtained for a standard proctor test is the following. Draw the compaction curve and the 100% saturation line for the test conducted. (10)

γ_{bulk} (gm/cc)	1.28	1.51	1.84	2.18	2.23	2.11	1.88	1.73
γ_{dry} (gm/cc)	1.25	1.45	1.74	2.02	2.03	1.88	1.65	1.49

(b) Describe the Spring Analogy in line with Terzaghi's demonstration of the Consolidation theory. (5)

2 (CO4) (a) Draw the schematics and explain the types of failures of soil specimens in a triaxial compression test. (3)

(b) Derive the expression for the corrected area for a triaxial compression test and a direct shear test. (4)

(c) A consolidated undrained test was conducted on a clay sample and the following results were obtained. (8)

Cell Pressure (kPa)	200	400	600
Deviator stress at failure (kPa)	118	240	352
Pore water pressure at failure (kPa)	110	220	320

Determine the shear strength parameters concerning (i) total stresses, and (ii) effective stresses.

3 (CO6) (a) Define: (i) Area Ratio (A_r), (ii) Recovery Ratio (R_r), (iii) Rock Quality Designation (RQD) (6)

(b) Compare the Standard Penetration Test and Cone Penetration Test. What are the correction factors that are to be considered to correct the Field-N value? (6)

(c) Mention the basic mechanism with possible schematic figure (if possible) for the following: (8)

(i) Pressuremeter Test
(ii) Dilatometer Test
(iii) Single and Double Packer Test
(iv) Seismic Refraction Test

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B.E. CIVIL ENGINEERING SECOND YEAR SECOND SEMESTER EXAM 2024

GEOTECHNICAL ENGINEERING I

Time: 3 Hours **PART II (50 Marks)** **Full Marks: 100 (50+50)**

Answer should be brief and to the point.
Assume any data reasonably if needed
Attempt All Questions

1. a) What is the difference between specific gravity of soil mass and specific gravity of soil solids. 2
   b) Derive the relationship between relative density and porosity 2
   c) Determine the value of the liquid limit from the following data: 5

No. of blows	Water Content (%)
38	16
34	17
20	20
12	22

   d) Sketch the plasticity chart used for classifying fine grained soil in the IS Soil Classification system and find the group symbol for the following soil: 3+2
   Liquid limit = 40% and Plastic limit = 22%
   e) Write the basic features of three important clay minerals (briefly). 6

CO1

2. a) Express the capillary rise in a tube in terms of surface tension and inner diameter of the tube. Prove the relationship. How the effective stress in the soil mass gets affected by capillary rise? 5+2
   b) Porosity of a soil is 40%. The permeability of the soil in falling head test was found to be 2.22×10^{-2} cm/s. Estimate the permeability of the soil when the porosity is 35%. 3
   c) What are the different application of flow-net. Derive the necessary relationship corresponding to each application. 10

CO2

3. a) A retaining wall 6 m high retains sand with $\phi = 30^o$ and unit weight 24 kN/m^{3}upto a depth of 3 m from top. From 3 m to 6 m the soil properties are: c = 20 kN/m^2 $\phi = 20^o$ and unit weight 18kN/m^3. Determine the total active pressure acting on the wall and the point of application. 8
   b) With neat sketch show how the lateral earth pressure changes with the movement of the wall. 2

CO5