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Reg No.:_____ Name:_____

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY

B.Tech Degree S4 (S, FE) / S4 (PT) (S, FE) Examination January 2024 (2015 Scheme)

Course Code: CE208

Course Name: GEOTECHNICAL ENGINEERING I (CE)

Max. Marks: 100 Duration: 3 Hours

(Graph sheets may be supplied on request)

PART A

Answer any two full questions, each carries 15 marks Marks

1 a) Define the terms: (i) Void ratio, (ii) Porosity, (iii) Degree of saturation, (iv) Water content, and (v) Air content 5

b) Derive the relationship between void ratio and porosity with the help of three phase diagram. 5

c) A soil specimen has a water content of 10% and a wet unit weight of 20 kN/m^3. If the specific gravity of soil solids is 2.70, determine the dry unit weight, void ratio, and the degree of saturation. Take unit weight of water = 10 kN/m^3. 5

2 a) Explain the IS Classification of soil 8

b) The weight of a chunk of moist soil is 0.196 kN and its volume is 0.011 m^3. After drying in the oven, the weight reduces to 0.162 kN. Determine: 7

i) Water content

ii) Unit weight of moist soil

iii) Dry unit weight

iv) Void ratio and

v) Degree of saturation

Take G = 2.7 and Unit weight of water = 10 kN/m^3

3 a) Expain the terms (i) Sensitivity (ii) Thixotropy 5

b) Explain the procedure for conducting hydrometer analysis? Also mention the corrections applied to hydrometer readings and equations used. 10

PART B

Answer any two full questions, each carries 15 marks

4 a) Determine the average coefficient of permeability in the horizontal and vertical directions for a deposit consisting of three layers of thickness 5m, 1m, and 2.5 m and having the coefficients of permeability of $3x10^{-2}$ mm/sec, $3x10^{-5}$ mm/sec, and $4x10^{-2}$ mm/sec, respectively. Assume the layers are isotropic. 6

b) A soil profile consists of a surface layer of clay 4m thick (unit weight = 19.5 kN/m^3) and a sand layer of 2m thick (unit weight = 18.5 kN/m^3) overlying an impermeable rock. The water table is at the ground surface. If the water level in a stand pipe driven into the sand layer rises 2m above the ground surface, draw the plot showing the variation of Total stress, porewater pressure and effective stress. Take γ_w=10 kN/m^3. 9

5 a) Differentiate between CU, CC and UU tests. 6

b) Explain the detailed procedure of Direct shear test with the help of a neat diagram 9

6 a) A sand deposit consists of 2 layers. The top layer is 2.5m thick (γ= 1709.67 kg/m^3) and the bottom layer is 3.5 m thick (γ_{sat} = 2064.52 kg/m^3). The water table is at a depth of 3.5 m from the surface and the zone of capillary saturation is 1m above the water table. Draw the diagrams showing the variation of total stress, neutral stress, and effective stress. Take γ_w=1000kg/m^3. 8

b) Explain Mohr Coloumb Failure theory. 7

PART C

Answer any two full questions, each carries 20 marks

7 a) Explain the terms i) Coefficient of compressibility ii) Coefficient of volume compressibility iii) Compression index 6

b) What is pre consolidation pressure? Explain the procedure for determining the consolidation pressure. 6

c) Explain different Compaction control methods used 8

8 a) Explain the graphical methods for determining the coefficient of consolidation with neat sketches. 8

b) Distinguish between normally consolidated, under consolidated, and over consolidated clays? 6

c) A stratum of clay is 2m thick has an initial overburden pressure of 50 kN/m^2 at its middle. Determine the final settlement due to an increase in pressure of 40 kN/m^2 at the middle of the clay layer. The clay is over consolidated, with a preconsolidation pressure of 75 kN/m^2. The values of coefficient of compression and compression index are 0.05 and 0.25 respectively. Take initial void ratio as 1.45. 6

9 a) Explain toe failure, base failure, and slip failure with suitable sketches 6

b) How the stability of slopes does is analysed using friction circle method? Explain with neat sketch. 7

c) A vertical cut is made in a clay deposit ($c = 30kN/m^2$, $\varphi = 0$, $\gamma = 16kN/m^3$). Find the maximum height of the cut which can be temporarily supported. Sn =0.261 7

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