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06CV54

Fifth Semester B.E. Degree Examination, May/June 2010
Geotechnical Engineering – I

Time: 3 hrs. Max. Marks:100

Note: ***1. Answer any FIVE full questions.***
2. Ordinary and semi-log graph sheets shall be provided.

PART – A

1 a. Differentiate between the following:
i) Voids ratio and porosity
ii) Water content and degree of saturation
iii) Absolute/true specific gravity and apparent specific gravity
iv) Air content and percentage air voids. **(10 Marks)**

b. A fully saturated sample has a water content of 25% and unit weight of 20 kN/m^3. Calculate:
i) Dry unit weight
ii) Specific gravity
iii) Voids ratio
iv) Porosity and
v) Its unit weight, when it has S = 50% use $\gamma_w = 10 kN/m^3$. **(10 Marks)**

2 a. What are the index properties for i) Cohesionless soils and ii) Cohesive soils? **(04 Marks)**

b. Derive the relation - $\gamma = \frac{(G+Se)\gamma_w}{1+e}$. **(06 Marks)**

c. A soil has 98% of particles finer than 10 mm, 59% finer than 1 mm, 24% finer than 0.1 mm, and 11% finer than 0.01 mm. Draw the grain size distribution curve and calculate the percentages of gravel, sand, silt and clay as per I.S. partial size classification. Also calculate C_u, C_c and report the gradation of soil. **(10 Marks)**

3 a. Explain how soils are classified according to I.S. classification. **(10 Marks)**

b. In a shrinkage limit test, the initial weight of soil was 1.93 N, initial volume was 106 cc and final weight and volume of soil after drying were 1.46 N and 77 cc. Determine the shrinkage limit, specific gravity initial and final voids ratio. Use $\gamma_w = 10$ kN/m^3. **(10 Marks)**

4 a. Derive the formula used to determine the coefficient of permeability in the falling head permeability test. **(10 Marks)**

b. Determine the average coefficient of permeability in directions parallel and perpendicular to bedding planes of a stratified deposit of soil consisting of 3 layers of total thickness 3m. The top and bottom layers are 0.5 m and 0.8 m thick. The values of K for top, middle and bottom layers are 2 x 10^{-4} cm/s, 3 x 10^{-3} cm/s and 1 x 10^{-2} cm/s respectively. **(10 Marks)**

PART – B

5 a. Differentiate between: i) Standard and modified proctor tests ; ii) Compaction and consolidation. **(10 Marks)**

b. The observations of a standard proctor test are given below:

Bulk unit weight (kN/m^3)	18.0	19.0	19.9	20.8	21.0	20.5	20.1
Water content (%)	9	11	13	15	16	17	18

Draw the compaction curve and determine OMC and maximum dry density. Also calculate the voids ratio and degree of saturation at OMC, if G = 2.6 and $\gamma_w = 10\ kN/m^3$. **(10 Marks)**

6 a. Define the following terms:
i) Coefficient of consolidation
ii) Compression index
iii) Degree of consolidation
iv) Primary consolidation and secondary compression. **(10 Marks)**

b. In a consolidation test, a soil sample 20 mm in thickness took 28 minutes to reach 90% consolidation under two – way drainage condition. For the same soil in the field what would be the time taken in days for 50% and 90% consolidation, if the thickness of soil layer is 4 m and if there is i) One way drainage and ii) Two – way drainage?. **(10 Marks)**

7 a. Explain the Mohr – Coulomb theory for shear strength of soils. **(05 Marks)**

b. What are the advantages and disadvantages of direct shear test? **(05 Marks)**

c. A direct shear test was conducted on a soil, whose results are given below:

Normal stress (kN/m^2) -	150	250
Shear stress at failure (kN/m^2)	110	120

Plot the graph and determine the shear strength parameters of the soil. If a triaxial test is conducted on the same soil, what would be the deviator stress at failure when the cell pressure is $150\ kN/m^2$? **(10 Marks)**

8 a. What are curve fitting methods used in consolidation test? Explain any one, with sketches. **(10 Marks)**

b. How do you classify the shear tests based on drainage conditions? When do you use each one of them? **(05 Marks)**

c. A saturated cohesive soil fails under an axial stress of $150\ kN/m^2$ in unconfined compression test. The failure plane makes an angle of 52° with horizontal. Calculate the shear parameters C and ϕ. **(05 Marks)**

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