CBCS Scheme

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15CT53

Fifth Semester B.E. Degree Examination, Dec.2017/Jan.2018
Geotechnical Engineering

Time: 3 hrs. Max. Marks: 80

Note: Answer any FIVE full questions, choosing one full question from each module.

Module-1

1 a. With the help of phase diagram explain :
i) Dry soil ii) Partially saturated soil iii) Saturated soil. **(06 Marks)**

b. With usual notations derive the expression $\gamma_d = \frac{G\gamma w}{1+e}$. **(04 Marks)**

c. A sample of soil has a volume of 1000CC and a weight of 17.5N. The specific gravity of soil solid is 2.52. If the dry unit weight is 15.8 kN/m^3, determine the water content, void ratio, submerged unit weight and degree of saturation. **(06 Marks)**

OR

2 a. Explain sand replacement method of determining in –situ density. **(06 Marks)**

b. Briefly explain BIS soil classification. **(06 Marks)**

c. A pycnometer was used to determine the water content of a sandy soil. The following observations were obtained.

Wt. of empty pycnometer	=	8N
Wt. of pycnometer + wet soil sample	=	11.6N
Wt. of pycnometer + Wet soil + water	=	20N
Wt. of pycnometer + water	=	18N
Specific gravity of soil solids	=	2.66

Compute the water content of soil sample. **(04 Marks)**

Module-2

3 a. With the help of sketches, explain the following soil structures :
i) Single grained ii) Flocculent iii) Honey combed iv) Dispersed. **(06 Marks)**

b. A laboratory compaction test on soil having specific gravity of 2.7 gave a maximum dry density of 18 kN/m^3 and a water content of 15%. Determine the degree of saturation, air content, and percentage air void at the maximum dry density. What would be the theoretical maximum dry density corresponding to zero air void at the optimum water content? **(10 Marks)**

OR

4 a. Explain the following clay minerals with sketches.

b. i) Kaolinite ii) Montmorillonite **(08 Marks)**

The following data were obtained from standard compaction test :

Water content :	9.5	11	12	14	16	18	19.5
Bulk unit weight (kN/m^3) :	18	19	19.6	20.5	21	20.5	20

Plat the moisture content verses dry unit weight. Determine optimum moisture content and maximum dry unit weight. **(08 Marks)**

Module-3

5 a. Explain total stresses, neutral stress and effective stress. **(06 Marks)**

b. Derive the expression for permeability in the case of variable head. **(05 Marks)**

c. A sample in variable head permeameter is 80mm in diameter and 180mm height. The permeability of sample is estimated to be 10×10^{-3} mm/s. It is designed that the head in stand pipe falls from 1000mm to 500mm in 3 minutes, determine the size of the stand pipe to be used for test. **(05 Marks)**

OR

6 a. Explain the following in connection with permeability of soil :
i) Seepage velocity ii) Superficial velocity iii) Capillary phenomena. **(06 Marks)**

b. A clay strata 6m thick laying below a sand layer 5m thick. The water table is located at a depth of 2m from the surface. The sand has porosity of 40% and specific gravity of 2.7. The sand above the water table maybe taken as dry. The water content of clay layer is 60% and specific gravity is 2.65. Calculate the effective stress at the middle of clay layer. **(10 Marks)**

Module-4

7 a. Explain mass – sparing analogy of consolidation of soils. **(06 Marks)**

b. Explain normally consolidated, under consolidated and over consolidated soils. **(06 Marks)**

c. A 3m thick layer of saturated clay in the field under surcharge loading will achieve 90% consolidation in 75 days in double drainage conditions. Find the coefficient of consolidation of the clay. **(04 Marks)**

OR

8 a. With the help of a neat sketch explain determination of pre-consolidation pressure by Casagrande's Method. **(06 Marks)**

b. A 20mm thick undisturbed sample of saturated clay is tested in laboratory with drainage allowed though top and bottom. Sample reaches 50% consolidation in 35 minutes. If clay layer from which sample was obtained is 3.0m thick and is free to drain through top and bottom surfaces, calculate the time required form same degree of consolidation in the field. What is the time required if the drainage in the field is only through the top? **(10 Marks)**

Module-5

9 a. Explain unconfined compression test method of determining shear strength parameters. **(06 Marks)**

b. Compute the shear strength of soil along a horizontal plane at a depth of 5m in a deposit sand having the following particulars :

Angle of internal friction ; ϕ = 36°
Dry unit height ; γ_d = 17 kN/m^3
Specific gravity ; G = 2.7

Assume the ground water table is at a depth of 2.4m from the ground level. Also determine change in shear strength, if water table rises up to ground level. **(10 Marks)**

OR

10 a. Write the advantages and disadvantages of direct shear test. **(04 Marks)**

b. Briefly explain different drainage conditions in triaxial shear test. **(06 Marks)**

c. The direct shear test conducted on a soil specimens given the following results at failure

Test No	Normal stress kN/m^2	Shear stress kN/m^2
1	100	50
2	150	70
3	200	90

Draw the Mohr's envelope and determine shear strength parameters. For any one failure point obtain principal stresses. **(06 Marks)**

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