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Fifth Semester B.E. Degree Examination, Dec.2015/Jan.2016
Geotechnical Engineering - I

Time: 3 hrs.   Max. Marks:100

Note: *Answer any FIVE full questions, selecting atleast TWO questions from each part.*

PART - A

1 a. With the help of three phase diagram for fully saturated soil, partially saturated soil and perfectly dry soil, define the following terms : i) Water content   ii) Degree of saturation   iii) Voids ratio   iv) Porosity. **(06 Marks)**

   b. Derive from first principle, the following phase relation :
   $$r_d = \frac{(1 - n_a)Gr_w}{1 + wG}$$
   (06 Marks)

   c. For a given soil, having specific gravity = 2.67, unit weight of 17.6 kN/m³ and moisture content of 10.8%, determine dry unit weight, voids ratio, porosity and degree of saturation. For the same soil, determine the weight of water, in kN to be added per cum of soil for 80% degree of saturation. **(08 Marks)**

2 a. State Stoke's law. List the assumptions and limitations of Stoke's law as applied to soil sedimentation. **(06 Marks)**

   b. With the help of particle size distribution curves, define the following terms : **(06 Marks)**
   i) Well graded soils ii) Poorly graded soils   iii) Gap – graded soils   iv) C_u and C_c.

   c. The following data was obtained from liquid limit test on a cohesive soil.

Number of blows (N)	40	35	22	14
Moisture content	25.5	28.0	32.5	36.0

   Plot the flow curve and determine the flow index and liquid limit. If the plastic limit of the soil is 18.5%, what are the plasticity and toughness indices? **(08 Marks)**

3 a. Explain the salient features of I.S plasticity chart for classification of fine grained soils. **(06 Marks)**

   b. List and explain the structure of three different clay minerals commonly found in soils. **(06 Marks)**

   c. The properties of soil as determined from laboratory test on three samples are as given below :

Soil	LL (%)	PL (%)	W_n (%)	Percent finer than 75µ
A	114	42	120	55
B	80	30	72	43
C	64	36	20	47

   Determine : i) The plasticity indices and classify the soils.
   ii) The liquidity indices and classify the consistency. **(08 Marks)**

4 a. Explain the following terms : i) Coefficient of Permeability ii) Quick sand condition   iii) Seepage velocity. **(06 Marks)**

   b. Derive an expression for the determination of coefficient of permeability by falling head permeameter. **(06 Marks)**

   c. A sand sample is tested in a permeameter 11.7cm high and 10.15 cm in diameter The quantity of water passing through the sample under an effective head of 10cm for a period of 90 seconds was measured 600 mℓ. Determine   i) Coefficient of permeability   ii) Coefficient of percolation and   iii) Seepage velocity. Assume the dry density of soil = 16.47 kN/m³ with sp. Gravity of soil solids = 2.64. **(08 Marks)**

PART - B

5 a. Explain briefly Mohr – Coulomb strength theory. Draw the failure envelopes for $\phi = 0$, $C = 0$ and $C - \phi$ soils. **(06 Marks)**

b. Define Sensitivity and Thixotrop as applied to cohesive soils. **(04 Marks)**

c. Calculate and draw the total, effective and pore water pressure distribution for a soil profile with properties as shown in fig. Q5(c). Assume specific gravity of soil = 2.70. **(10 Marks)**

Fig.Q5(c)
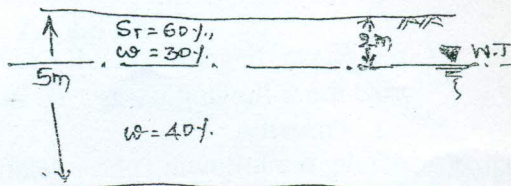
6 a. Distinguish between standard and modified proctor tests. **(04 Marks)**

b. List and explain briefly the factors affecting compaction. How does compaction differs from consolidation. **(06 Marks)**

c. Data from a laboratory Proctor compaction test on clayey sand is as given below. Plot the compaction curve and find OMC and maximum dry density. If the specific gravity of soil solids is 2.75, find the voids ratio and degree of saturation at OMC. **(10 Marks)**

Water content (%)	6.5	10.5	14.5	18.5	22.5	26.5
Bulk density (kN/m^3)	14.0	18.04	20.0	21.05	21.00	18.99

7 a. Briefly explain consolidation using spring analogy. **(06 Marks)**

b. Explain Casagrande's method of determination of preconsolidation pressure. **(06 Marks)**

c. In a consolidation test, voids ratio decreased from 0.80 to 0.65, when the pressure was changed from 100kN/m^2 to 200kN/m^2. Determine i) Compression Index ii) Coefficient of compressibility and iii) Coefficient of volume change. **(08 Marks)**

8 a. Explain the merits and demerits of direct shear test. **(04 Marks)**

b. A laboratory consolidation test was performed on a specimen of clay 25mm thick, drained both at top and bottom. The time required for 50% consolidation was 12 minutes. Determine the coefficient of consolidation of clay. Also calculate the time required for same degree of consolidation (50%) for this clay deposit 5m thick and drained at top end only. **(06 Marks)**

c. The following results were obtained from a consolidated undrained test on a normally consolidated clay. Plot the strength envelope in terms of total stresses and effective stresses and determine cohesion intercept and angle of shearing resistance. **(10 Marks)**

Sl. No	Cell Pressure (kN/m^2)	Deviator stress (kN/m^2)	Pore water Pressure (kN/m^2)
1	250	152	120
2	500	300	250
3	750	455	350

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