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P.E.S. College of Engineering, Mandya - 571 401
(An Autonomous Institution affiliated to VTU, Belgaum)
Fifth Semester, B.E. – Civil Engineering
Semester End Examination; Dec - 2016/Jan - 2017
Geotechnical Engineering - I

Time: 3 hrs   Max. Marks: 100

*Note: Answer **FIVE** full questions, selecting **ONE** full question from each unit.*

UNIT - I

1 a. Explain with neat sketch, the structure and characteristics of Kaoliuite clay mineral.   6

  b. Explain the terms :
     Vander walls bond and exchangeable Cata-ions.   6

  c. Differentiate between :
     i) Flocculated structures and dispersed structures
     ii) Primary and secondary valence forces.   8

2 a. With the help of three phase diagram for fully saturated soil, partially saturated soil and
     perfectly dry soil, define the following terms :   6
     i) Water content cut   ii) Degree of saturation   iii) Voids ratio   iv) Porosity.

  b. Derive from first principle, the following phase relation;

     $$\gamma_d = \frac{(1-n_a)G\gamma_w}{1+WG}.$$ 6

  c. For a given soil, having G = 2.67, unit weight of 17.6 kN/m^3 and moisture content of
     10.8%, determine the 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   8
     of saturations.

UNIT - II

3 a. State Stoke's law. List the assumptions and limitations of Stoke's law as applied to soil
     sedimentation.   6

  b. With the help of particle size distribution curves, define the following terms:
     i) Well graded soils   ii) Poorly graded soils   iii) Gap-Graded soils.   6

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

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

8

     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?

4 a. Explain the salient features of I.S. plasticity chart for classification of fine grained soils.   6

  b. How do you distinguish between silt and clay in the field?   6

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

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

8

Determine;

i) The plasticity indices and classify the soils

ii) The liquidity indices and classify the consistency.

UNIT - III

5 a. Explain the following terms :

i) Coefficient of permeability

ii) Coefficient of percolations

ii) Seepage velocity.

6

  b. Derive an expression for the determination of coefficient of permeability by falling head permeameter.   6

  c. A sand sample is tested in a permeameter 11.7 cm high and 10.15 cm in diameter. The quantity of water passing through the sample under an effective head of 10 cm for a period of 90 secs. was measured 600 *ml*. Determine;

i) Coefficient of permeability

ii) Coefficient of percolation and seepage velocity.

Assume the day density of soil = 16.47 kN/m^3 with G = 2.64.

8

6 a. Distinguish between standard and modified proctor tents.   4

  b. List and explain briefly the factors affecting compactions. How does compaction differ from consolidation?   6

  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 of the specific gravity of soil solids is 2.75, find the voids ratio and degree of saturation at OMC.   10

Water content (%)	6.5	10.5	14.5	18.5	22.50	26.50
Bulk density (kN/m^3)	14.0	18.04	20.0	21.05	21.00	18.99

UNIT - IV

7 a. Define:

   i) Total stress   ii) Effective stress   iii) Neutral stress.   6

 b. Explain the quick sand phenomenon in soils.   6

 c. A 12 m thick bed of sand is underlined by a layer of 7 m thick clay. The water table which was originally at the ground surfaces is lowered by drainage to a depth of 2 m, thereupon the degree of saturation above the lower water table is reduced to 25%. Determine the increase in magnitude of the effective stress at the centre of clay layer due to lowering water table. The saturated densities of sand day one 22 kN/m^3 and 19 kN/m^3 respectively. The dry density of sand is 18 kN/m^3.   8

8 a. Briefly explain consolidation using spring analogy.   6

 b. Explain Casagrande's method of determination of pre consolidation pressure.   6

 c. In consolidation tests, voids ratio decreased from 0.80 to 0.65, when the pressure was changed from 100 kN/m^2 to 200 kN/m^2. Determine;

   i) Compression index   8

   ii) Coefficient of compressibility

   iii) Coefficient of volume change.

UNIT - V

9 a. Explain briefly Mohr-coulomb strength theory. Draw the failure envelopes for $\phi = 0$, $C = 0$ and C - ϕ soils.   6

 b. Define Sensitivity and Thixotropy as applied to collective soils.   6

 c. A vane 112.5 mm long 75 mm in diameter was pressed into a soft clay at the bottom of a bore hole. Torque was applied to fail the soil. The shear strength of the clay was found to be 37 kN/m^2. Determine the torque that was applied.   8

10 a. Explain the merits and demerits of direct shear test.   6

 b. How are the shear tests classified based on drainage condition? Under what condition each of these tests is to be preferred?   6

 c. A cylindrical specimen of saturated soils failed under an axial stress 150 kN/m^2 in an U.C.C. test. The failure plane makes an angle of 52º with the horizontal. Calculate the cohesion and angle of friction of soil.   8

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