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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. - 2015
Geotechnical Engineering - I

Time: 3 hrs   *Max. Marks: 100*

*Note: i) Answer any **FIVE** full questions selecting **ONE** full question from each **unit**.*
ii) Assume missing data suitably.

UNIT - I

1 a. Explain the different types of soil structure of coarse-grained soils.   6

  b. Explain three basic clay minerals.   6

  c. Explain difference between:

   (i) Primary and secondary valence bands   8

   (ii) Flocculated and dispersed structure

2 a. Define; (i) void ratio (ii) Degree of saturation (iii) submerged density   6

  b. With the help of a three phase diagram and usual notations prove that

$$\gamma_d = \frac{(1-\eta a)G\gamma w}{1+e}$$

6

  c. The soil sample in its natural state has a water content of 35%, when it is fully saturated. Determine porosity, dry and bulk unit weights. Calculate the weight of water required to saturate a soil mass of volume 10 m^3. Assume G = 2.70   8

UNIT - II   `

3 a. Define; (i) Plastic limit (ii) Shrinkage index (iii) liquidity index   6

  b. Explain the procedure of determining liquid limit by percussion cup dence method.   6

  c. The mass of soil coated with a layer of paraffin wax weighs 691 gm and the soil alone weighs 683 g, when the soil sample immersed in water, it displaced 350 ml of water. The specific gravity of the soil is 2.75 and that of the wax is 0.89, determine void ratio, bulk density, dry density and degree of saturation, if the soil has got as water content of 17% unit weight of water is 10 kN/m^3.   8

4 a. Explain IS plasticity chart.   6

  b. Explain USCS classification system.   6

  c. The following results are obtained from a laboratory test.

   In a sieve analysis 500gms mass of soil sample, it was observed that 48 gms of the soil sample was retained on 75 mm sieve. The liquid limit data obtained from a percussion cup device in given below: 8

No. of blows(N) :	15	20	23	28	34
Water Content (%)	62	60.6	59.4	58.4	56.8

The plastic limit of the soil is 24%. Show the position of the soil on the plasticity chart and classify the soil as per IS: 1498-1970.

UNIT - III

5 a. Briefly explain the factors affecting permeability of soils.   6

  b. Explain the constant head permeability test.   6

  c. A constant head permeability contains a sand sample of 21 cm length, 25cm square area under a head of 41 cm. The discharge was found to be 190 cc in 120 sec. The specific gravity of the soil grains in 2.68. Determine the coefficient of permeability, superficial velocity and coefficient of percolation.   8

6 a. Explain the factors affecting compaction of soils.   4

  b. Discuss the effect of compaction on soil properties.   6

  c. Following are the results of a proctor compaction test in the laboratory.

Mass of mould +wet soil (in gm)	2925	3095	3150	3125	3070
Water content (%)	10.0	12.0	14.3	16.1	18.2

Volume of the mould : 1000 ml   10

Mass of mould : 1000 gm.

Specific gravity of soil solids = 2.70

Plot the compaction curve showing the optimum moisture content and maximum dry density.

UNIT - IV

7 a. Explain Terzaghi's Effective stress equation and state its limitations.   4

  b. Explain log-log method of determining pre consolidation pressure.   6

  c. A laboratory consolidation test was performed on a 20 mm thick sample of silty clay and the following results were obtained:

Pressure kN/m^2	Final dial gauge reading (mm)	Pressure kN/m^2	Final dial gauge reading (mm)
0	5.59	200	3.964
25	5.234	400	3.515
50	4.960	800	2.785
100	4.604	1600	5.235

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The final moisture context of the sample after swelling was found to be 32.5%. The specific gravity of the soil solids is 2.70

 (i) Plot e-logσ curve

 (ii) Determine the compression index and coefficient of volume change of the soil.

8 a. Differentiate between normally consolidated, over consolidated and under consolidated soils. 6

 b. Explain the procedure after determining pre-consolidation pressure by casagrande method. 4

 c. Find the time required for 50% consolidation of the soil stratum 9 m thick with a pervious strata on top and bottom. Also determine the coefficient of consolidation given that $K = 10^9$ m/s, $e_0 = 1.50$, $a_v = 0.003$ m^2/kN, Time Factor = 0.20 10

UNIT - V

9 a. Explain Mohr-Coloumb facture theory. 6

 b. Explain unconfined compression test. 6

 c. A cylindrical soil specimen having cohesion of 80 kN/m^2 and angle of internal friction of 21° is subjected to cell pressure of 100 kN/m^2. In a triaxial testing machine. Compute. 8

    (i) The maximum deviator stress at which the sample will fail.

    (ii) The angle made by the failure plane with the axis of the specimen.

10 a. Explain vane shear test. 6

 b. Explain the factors affecting shear strength of soil 4

 c. A soil has an unconfined compressive strength of 120 kN/m^2. In a trial compression test on a specimen of the same soil when subjected to a chamber pressure of 40 kN/m^2 failed at an additional stress of 160 kN/m^2. Determine; 10

    (i) Shear strength parameter of the soil

    (ii) The angle made by the failure plane with the axial stress in the triaxial test.

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