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P.E.S. College of Engineering, Mandya - 571 401

(An Autonomous Institution affiliated to VTU, Belagavi)

Fifth Semester, B.E. - Civil Engineering

Semester End Examination; Dec - 2017/Jan - 2018

Basic Geotechnical Engineering

Time: 3 hrs *Max. Marks: 100*

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

UNIT - I

1 a. Briefly explain the three different clay minerals with neat sketch. 8

b. Write a short note on : 6

i) Electrical Diffuse double layer ii) Absorbed water.

c. Differentiate between :

i) Primary and Secondary Valence Bonds 6

ii) Base exchange capacity and Isomorphus substitution.

2 a. Define : i) Water content ii) Saturated unit weight 8

iii) Degree of saturation iv) Voids ratio.

b. Prove that $e = \frac{WG}{S}$. 6

c. Saturated clay has a water content of 39.3% and a bulk specific gravity of 1.84. Determine; 6

i) Void ratio ii) Specific gravity of particles.

UNIT - II

3 a. Define : i) Liquid limit ii) Plastic limit iii) Shrinkage limit iv) Plasticity index. 8

b. With the help of particle-size distribution curve define the terms : 7

i) Effective size ii) Uniformity coefficient iii) Coefficient of curvature.

c. A soil has a liquid limit of 35%, plastic limit of 15%, flow index of 13% and natural water content of 18%. Determine the plasticity index, toughness index and liquidity index. 5

4 a. With the help of plasticity chart, explain the IS classification of soil. 8

b. Write a short note on : 12

i) Highway Research Board classification ii) Textural classification

iii) Particle size classification.

UNIT - III

5 a. Derive the expression for coefficient of permeability used in falling head permeability test. 6

b. Briefly explain the factors affecting the permeability of soil. 8

c. Calculate the coefficient of permeability of a soil sample 6 cm in height and 50 cm^2 in cross sectional area, if a quantity of water equal to 430 ml is passed down in 10 minutes, under an effective constant head of 40 cm. On over-drying, the test specimen has mass of 498 g. Taking G = 2.654, calculate the seepage velocity of water during the test. 6

Contd…2

6 a. List the difference between standard proctor test and modified proctor. 4

b. Explain the effect of compaction on soil properties. 10

c. Calculate the compaction energy used in standard proctor and modified proctor test. Take V = 945 ml. 6

UNIT - IV

7 a. Differentiate between primary consolidation settlement and secondary consolidation settlement. 6

b. Explain with sketch total, neutral and effective pressure in soil. 8

c. Explain the quick sand phenomenon in soil. 6

8 a. Explain the determination of coefficient of consolidation by Taylor square root of Time fitting method. 6

b. Briefly explain the mass-spring analogy of soil. 8

c. An undisturbed sample of clay stratum, 2 m thick, was tested, in the laboratory and the average value of the coefficient of consolidation was found to be $2x10^{-4}$ cm^2/s. If a structure is built on the clay stratum, how long will it take to attain half the ultimate settlement under the load of the structure? Assume double drainage. 6

UNIT - V

9 a. With neat sketch, explain the Direct shear test. 10

b. Undrained triaxial tests are carried out on four identical specimen of silty clay and the following results are obtained.

Cell Pressure (kN/m^2)	50	100	150	200
Deviator Stress (kN/m^2)	350	440	530	610
Pore Pressure (kN/m^2)	5	10	12	18

10

Determine the value of the effective angles of shearing resistance and the cohesion intercept by plotting i) Conventional failure envelope from Mohr circles

ii) Modified failure envelope.

10 a. Explain Mohr-Coulomb Failure Theory. 6

b. A vane, 10 cm long and 8 cm in diameter, was pressed into soft clay at the bottom of a bore hole. Torque was applied and gradually increased to 45 N-m when failure took place. Subsequently, the vane rotated rapidly so as to completely remained the soil. The remouled soil was sheared at a torque of 18 N-m. Calculate the cohesion of the clay in the natural and remoulded state and also the value of sensitivity. 8

c. A cylindrical specimen of saturated clay, 4 cm in diameter and 9 cm in tested in an unconfined compression tester. The specimen has coned ends and its length between the apices of cone is 8 cm. Find the unconfined compressive strength of clay, if the specimen fails under an axial load of 46.5 N. The change in the length of specimen @ failure is 1 cm. 6

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