Code No: 125EQ

R15

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD
B. Tech III Year I Semester Examinations, November/December - 2017
GEOTECHNICAL ENGINEERING
(Common to CEE, CE)

Time: 3 hours Max. Marks: 75

Note: This question paper contains two parts A and B.
Part A is compulsory which carries 25 marks. Answer all questions in Part A. Part B consists of 5 Units. Answer any one full question from each unit. Each question carries 10 marks and may have a, b, c as sub questions.

PART - A

(25 Marks)

1.a) A soil has bulk unit weight of 18 kN/m^3. If the water content of soil is 10%, estimate its dry unit weight. [2]

b) A clay soil has liquid limit and plastic limits 70% and 30% respectively. If the liquidity index of clay is 0.5, estimate its natural moisture content and plasticity index. [3]

c) Prove that the shear strength of soil is zero during quick sand condition. [2]

d) A soil has seepage velocity as 1×10^{-3} cm/s, and porosity 0.45, estimate its discharge velocity. [3]

e) Write the assumptions of Boussinesq's theory. [2]

f) Define compaction effort with formula. [3]

g) A soil has failure angle as 60^0, then estimate its angle of internal friction. [2]

h) Define critical void ratio and draw the void ratio variations for loose and dense sand with the strain. [3]

i) Define coefficient of volume compressibility and compression index. [2]

j) Write the reasons for pre consolidation of soil. [3]

PART - B

(50 Marks)

2.a) Define :
(i) Void ratio, (ii) Porosity, (iii) Degree of saturation, (iv) Water content, (v) Dry density, (vi) Bulk density, (vii) Submerged density.

b) Derive from fundamentals:
$S.e = w.G$,
Where; S represents degree of saturation, e represents void ratio, w represents water content, and G represents grain specific gravity.

c) A soil has porosity 40% and specific gravity 2.67, estimate its dry unit weight. Assume unit weight of water as 10 kN/m^3. [4+3+3]

OR

3.a) Sketch typical complete grain-size distribution curves for (i) well graded soil and (ii) uniform silty sand. Form the curves, determine the uniformity coefficient and effective size in each case. What qualitative inferences can you draw regarding the engineering properties of each soil?

b) The following data refer to a sample of soil:
Percent passing 4.75 mm IS Sieve = 64
Percent passing 75-μ IS Sieve = 6
Uniformity Coefficient = 7.5
Coefficient of Curvature = 2.7
Plasticity index = 2.5
Classify the soil. [4+6]

4.a) What are the various parameters that effect the permeability of soil in the field ? Critically discuss.

b) A uniform homogeneous sand deposit of specific gravity 2.60 and void ratio 0.65 extends to a large depth. The ground water table is 2 m from ground level. Determine the effective, neutral, and total stress at depths of 2 m and 6 m. Assume that the soil from 1 m to 2 m has capillary moisture leading to degree of saturation of 60%. [4+6]

OR

5.a) Define coefficient of permeability and list four factors on which the permeability depends.

b) A concrete dam retains water to a height of 9 m. It has rows of sheet piling at both heel and toe which extend half way down to an impervious stratum. From a flow net sketched on a transformed section, it is found that there are four flow channels and sixteen head drops. The average horizontal and vertical permeabilities of the soil are 6×10^{-3} mm/s and 2×10^{-3} mm/s, respectively. What is the seepage per day, if the length of the dam is 150 metres? [4+6]

6.a) Write a brief note on the 'compaction in the field' bringing out the various types of rollers and their effectiveness with respect to different soil types.

b) The following results were obtained in a compaction test. Determine the optimum moisture content and the maximum dry density by plotting the data. [4+6]

Moisture Content (%)	7.4	9.7	10.5	11.5	13.1	14.4
Bulk Unit Weight (kN/m^3)	18.81	20.07	20.52	21.06	21.06	20.07

OR

7.a) Write a brief critical note on 'Newmark's influence chart'.

b) A ring foundation is of 3 m external diameter and 2.00 m internal diameter. It transmits a uniform pressure of 90 kPa. Calculate the vertical stress at a depth of 1.5 m directly beneath the centre of the loaded area. [6+4]

8.a) Distinguish between normally consolidated and over consolidated soils. Explain in detail any one method for determining the coefficient of consolidation of a soil.

b) A clay stratum is 4.5 m thick and rests on a rock surface. The coefficient of consolidation of a sample of this clay was found to be 4.5×10^{-8} m^2/s in the laboratory. Determine probable period of time required for the clay stratum to undergo 50% of the ultimate settlement expected under a certain increment of pressure. [5+5]

OR

9.a) What is preconsolidation pressure? Explain the Casagrande's graphical method for its evaluation.

b) A soft, normally consolidated clay layer is 18 m thick. The natural water content is 45%. The saturated unit weight is 18 kN/m^3, the grain specific gravity is 2.70 and the liquid limit is 63%. The vertical stress increment at the centre of the layer due to the foundation load is 9 kN/m^2. The ground water level is at the surface of the clay layer. Determine the settlement of the foundation at the centre of the layer. [4+6]

10.a) What are the advantages and disadvantages of a triaxial compression test? Briefly explain how you conduct the test and compute the shear parameters for the soil from the test data.

b) From a direct shear test on an undisturbed soil sample, the following data have been obtained. Evaluate the undrained strength parameters by plotting the results. [5+5]

Normal Stress (kPa)	70	96	114
Shear Stress (kPa)	138	156	170

OR

11.a) Differentiate between unconsolidated undrained test and a drained test. Under what conditions are these test results used for design purposes?

b) An embankment consists of clay fill for which cohesion is 25 kPa and angle of internal friction is 27^0 (from consolidated undrained tests with pore-pressure measurement). The average bulk unit-weight of the fill is 20 kN/m^3. Estimate the shear-strength of the material on a horizontal plane at a point 20 m below the surface of the embankment, if the pore pressure at this point is 180 kPa as shown by a piezometer. [5+5]

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