Code No: 155BN **R18**

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD
B. Tech III Year I Semester Examinations, March - 2024
GEOTECHNICAL ENGINEERING
(Civil Engineering)

Time: 3 Hours **Max. Marks: 75**

Note: i) Question paper consists of Part A, Part B.
ii) Part A is compulsory, which carries 25 marks. In Part A, Answer all questions.
iii) In Part B, Answer any one question from each unit. Each question carries 10 marks and may have a, b as sub questions.

PART – A
(25 Marks)

1.a)	Define bulk unit weight and dry unit weight.	[2]
b)	Define consistency index and write its values for different consistency of clay.	[3]
c)	Define permeability of soil and write its importance.	[2]
d)	Define Darcy's law and write its limitations.	[3]
e)	Draw vertical stress distribution along vertical plane due to point load.	[2]
f)	Define degree of compaction. Write its significance.	[3]
g)	Define preconsolidation pressure.	[2]
h)	What is maximum drainage path in case of single and double drainage systems?	[3]
i)	How do you obtain shear strength parameters in UCS test?	[2]
j)	How does soil derive its shear strength?	[3]

PART – B
(50 Marks)

2.a) Derive the following expression:

$$\gamma = \frac{(G + es)\gamma_w}{(1 + e)}$$

b) The porosity of a soil sample is 35% and the specific gravity of its particles is 2.7. Calculate its void ratio, dry unit weight, saturated unit weight and submerged unit weight. Also calculate the bulk unit weight of soil, if its degree of saturation is 50%. [5+5]

OR

3.a) Write the Plasticity chart and explain how fine-grained soils are classified.
b) The following observations are made in a laboratory test on a soil sample: Wet weight = 960.3 g, wet volume = 510.20 cm^3, oven dried weight = 810.32 g, specific gravity of solids, G = 2.7. Find the void ratio, degree of saturation and dry density. [5+5]

4.a) Derive the expression for coefficient of permeability in case of falling head method.
b) In order to compute the seepage loss through the foundation of a gravity dam, flow nets were constructed. The result of the flow net analysis gave N_f= 5, N_d = 14. The difference in water levels of u/s to d/s is 24 m. If the hydraulic conductivity of the soil is 1.35×10^{-4} m/s, compute the seepage loss over 100 m length of dam per day. [5+5]

OR

5.a) What is seepage? Discuss how flow nets are constructed? Write the uses of flow nets?

b) A sample in a variable head permeameter is 100 mm in diameter and 120 mm high. The permeability of the sample estimated to be 4×10^{-4} cm/s. if it is desired that the head in the stand pipe should fall from 160 cm to 120 cm in 180 s, determine the size of the stand pipe which should be used. [5+5]

6.a) Why soils are required to be compacted? Discuss methods of soil compaction in the field.

b) A ring footing of external diameter 12 m and internal diameter 8 m rests at a depth 4 m below the ground surface. It carries a load intensity 200 kPa. Find the vertical stress at depths of 5 and 10 m below the center of footing base. You may neglect the overburden in the excavated portion. [5+5]

OR

7.a) Explain the concept Newmark's influence chart along with its construction procedure.

b) A rectangular area of 3m × 6m carries a uniformly distributed load 120 kPa at ground surface. Find the vertical pressure at 4m below the centre and corner of the loaded area. Solve the problem by i) dividing the rectangle into four equivalent rectangles, and ii) 2:1 method. [5+5]

8.a) Write the assumptions of Terzaghi's one dimensional consolidation theory.

b) At a given site (site A) having a clay layer 8m thick with single drainage, a uniform fill that was constructed resulted in a settlement of 50mm in 1 year, corresponding to 50% average degree of consolidation. It was found that at a neighboring site (site B), the same type of clay of thickness 16m exists with single drainage. How long will it take for 50% consolidation to occur? [5+5]

OR

9.a) Discuss the under consolidated, normally consolidated and over consolidated soils with clear examples.

b) A layer of clay 2 m thick is subjected to a loading of 50 kN/m^2. One year after loading the clay layer an average consolidation observed is 50%. If the clay layer has double drainage system, determine the coefficient of consolidation. If the coefficient of permeability of clay layer is 10^{-10} m/s, what is the settlement after one year under the same loading? How much time will the 2 m thick layer take to reach 90% consolidation? [5+5]

10.a) Discuss the shear strength characteristics of cohesionless soil.

b) The flowing test results are obtained from the direct shear test. Compute the shear strength parameters. Dimensions of the sample are 6 cm × 6 cm × 2 cm. [5+5]

Normal stress (kg/cm^2)	0.3	0.4	0.5	0.6	0.7
Shear Load (kg.)	6.75	9.0	11.25	13.50	15.75

OR

11.a) Discuss what is sensitivity of clay. Explain how you estimate it? Discuss the benefits of direct shear test.

b) Given the following data from a consolidated undrained test with pore water pressure measurement, determine the effective stress strength parameters: [5+5]

$\sigma 3$	100 kN/m^2	200 kN/m^2
$(\sigma 1 - \sigma 3)$	150 kN/m^2	192 kN/m^2
uf	60 kN/m^2	140 kN/m^2.

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