Registration No.: | | | | | | | | | | |

Total Number of Pages: 02 **Course: IDD (B.Tech and M.Tech)**
Sub_Code: RCI5C003

5th Semester Regular/Back Examination: 2024-25
SUBJECT: Geotechnical Engineering
BRANCH(S): C&EE, CIVIL, CE,
Time: 3 Hours
Max Marks: 100
Q.Code: R070

Answer Question No.1 (Part-1) which is compulsory, any eight from Part-II and any two from Part-III.
The figures in the right hand margin indicate marks.

Part-I

Q1 **Answer the following questions:** **(2 x 10)**

a) Distinguish between Residual and Transported soil.
b) Differentiate between Compaction and Consolidation.
c) Establish the relationship between void ratio and porosity of soil mass.
d) What are the assumptions made by Boussinesq's in deriving the expression for stress in soil due to a point load on the ground surface?
e) State the different modes of soil water.
f) Define Consistency Limits. Why they are required to find in geotechnical Engineering?
g) Draw the Mohr's circle for unconsolidated undrained test and explain about failure envelop.
h) Write the equation of the A-line, and explain the terms in it.
i) Draw a typical grain size distribution curves for different types of soils.
j) What is the use of New mark's influence chart?

Part-II

Q2 **Only Focused-Short Answer Type Questions- (Answer Any Eight out of Twelve)** **(6 x 8)**

a) The mass of wet soil when compacted in a mould was 19.6 kN. The water content of the soil was 15%. If the volume of the mould was 0.96 m^3, Determine (i) dry unit weight, (ii) Void ratio, (iii) degree of saturation and (iv) percent air voids. Take G = 2.7.
b) Differentiate between Standard Proctor Test and Modified Proctor Test.
c) For a gravel with D_{60} = 4.8 mm, D_{30} = 1.25 mm and D_{10} = 0.35 mm, calculate the uniformity coefficient and coefficient of curvature. Is it a well graded or a poorly graded soil?
d) The laboratory tests on a sample of soil gave the following results:
w_n = 24 %, w_L = 62 %, w_p = 28 %, percentage of particles less than 2 microns = 23%.
Determine: (i) The liquidity index, (ii) activity, (iii) consistency and nature of soil.

e) Differentiate between shear strength parameters obtained from total and effective stress considerations.

f) What is relation between OMC and MOD? Draw the graph for zero air voids.

g) Define Quick sand condition and derive the expression for critical hydraulic gradient.

h) Discuss the drainage conditions generally used in tri-axial compression test.

i) State and explain Darcy's law.

j) What do you understand by 'Pressure bulb'? Illustrate with sketches.

k) Discuss Terzaghi's theory of consolidation by stating the various assumptions and its validity.

l) State under consolidated, normally consolidated, and over consolidated soil with example.

Part-III

Only Long Answer Type Questions (Answer Any Two out of Four)

Q3 a) Describe the formation of soil due to mechanical weathering. **(8)**

b) A soil stratum consists of 3 layers of thickness 1 m, 1.5 m and 2.0 m having the coefficient of permeability of 2 x 10^{-3} cm/s, 1.5 x 10^{-3} cm/s and 3 x 10^{-3} cm/s respectively. Estimate the average co-efficient of permeability in the direction i) parallel to the bedding plane ii) normal to the bedding plane. **(8)**

Q4 a) Explain the properties of flow net. **(6)**

b) An 8 m thick layer of saturated clay is overlain by 4.0 m deep sand. The water table is 2.0 m below the ground surface. The saturated clay and sand are 21 kN/m^3 and 19 kN/m^3 respectively. The unit weight of sand above the water table is 16 kN/m^3. Find out the total and effective vertical pressure at the water table, at top, middle, and bottom of clay layer. **(10)**

Q5 a) What are the factors that affect compaction? **(8)**

b) A monument 5000 kN is erected on the ground surface. Considering the load as concentrated, determine the vertical pressure directly under the monument at a depth of 10 m below the ground surface. Also calculate the vertical pressure at a point, which is at a deputation of 10 m and a horizontal distance of 5 m from the axis of the load. **(8)**

Q6 a) Describe the direct shear test. What are its merits and demerits compared to Triaxial test? **(6)**

b) Two identical specimens of soil were tested in a tri-axial apparatus. The first specimen failed at a deviator stress of 800 kN/m^2 when the cell pressure was 200 kN/m^2 while the second specimen failed at a deviator stress of 1400 kN/m^2 when the sell pressure was 300 kN/m^2. Determine c and ϕ for the soil. **(10)**