Code No: R2022354 **R20** **SET - 1**

II B. Tech II Semester Supplementary Examinations, December - 2022
SOIL MECHANICS
(Agricultural Engineering)

Time: 3 hours **Max. Marks: 70**

Answer any **FIVE** Questions, each Question from each unit
All Questions carry **Equal** Marks

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UNIT – I

1 a) The results of a sieve analysis of a soil are given below. Total mass of sample = 900 g. [7M]

IS sieve	20 mm	10 mm	4.75 mm	2 mm	1.0 mm	0.6 mm	4.25 µ	212 µ	150 µ	75 µ	Pan
Mass of soil retained (gm)	35	40	80	150	150	140	115	55	35	25	75

Draw the particle size distribution curve and hence determine the uniformity coefficient and the coefficient of curvature.

b) Define total, neutral and effective stresses. What is the significance of effective stress. Derive the expression for effective stress. [7M]

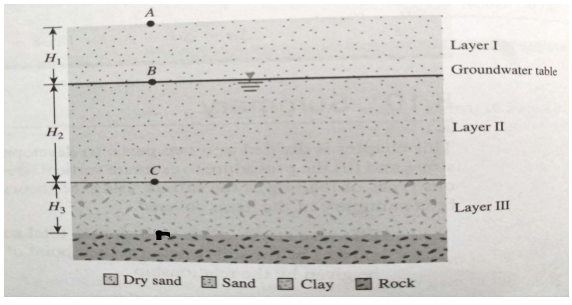
Or

2 a) The moist weight of 5.66 x 10^{-3} m^3 of a soil is 102.3 x 10^{-3} kN. The moisture content and the specific gravity of the soil solids are determined in the laboratory to be 11% and 2.70, respectively. Calculate the following: [7M]

i) Bulk unit weight ii) Dry unit weight iii) Void ratio
iv) Porosity v) Degree of Saturation vi) Volume occupied by water

b) Refer to the figure given below. Calculate σ, u, and σ' at A, B, C and D for the following cases and plot the variations with depth. (Note e= void ratio, ω= water content, G_s= specific gravity of soil solids, γ_d=dry unit weight and γ_{sat}=saturated unit weight) [7M]

Problem	Layer I	Layer II	Layer III
i)	H_1= 1.5m γ_d=17.6kN/m^3	H_2= 1.83m γ_{sat}=18.87kN/m^3	H_3= 2.44m γ_{sat}=19.65kN/m^3
ii)	H_1=4m e = 0.6 G_s= 2.65	H_2 = 3 m e= 0.52 G_s= 2.68	H_3= 1.5m ω = 40%, e= 1.1



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UNIT – II

3 a) Determine the vertical stress at a point P which is 3 m below and at a radial distance of 3 m from the vertical load of 100 kN using both Boussinesq and Westergaard's equation. [7M]

b) What is an influence diagram? How is it used in practice? Compare the Boussinesq's and Westergaard's theories for determining stresses under loads. [7M]

Or

4 a) State the assumptions made in computing stresses below the ground surface due to a point load acting on it. Discuss their validity in practice. [7M]

b) A reinforced concrete water tank of size 6m x 6m resting on ground surface carries a uniformly distributed load of 200 kN/m^2. Estimate the maximum vertical pressure at a depth of 12 m vertically below the center of the base. [7M]

UNIT – III

5 a) The data from a series of consolidated undrained triaxial test are summarized below. Draw the three Mohr circles and plot the failure envelope in terms of the total and effective stresses, and obtain c' and ϕ'. [7M]

Samplenumber	Cell pressure(kN/m^2)	Deviator stress at failure(kN/m^2)	Pore water pressure at failure(kN/m^2)
1	100	88.2	57.4
2	200	138.5	123.7
3	350	232.1	208.8

b) What is the effect of compaction on engineering properties of the soil? How would you decide whether to compact on dry of optimum or wet of optimum? [7M]

Or

6 a) Describe the triaxial shear test. What are the advantages of triaxial shear test over the direct shear test? [7M]

b) The in-situ moisture content of a soil is 18% and the moist unit weight is 166.5 kN/m^3. The specific gravity of soil solids is 2.75. This soil is to be excavated and transported to a construction site for use in a compacted fill. If the specifications call for the soil to be compacted to a minimum dry unit weight of 16.27 kN/m^3 at the same moisture content of 18%, obtain the quantity of soil needed from the excavation site, to produce 7651 m^3 of compacted fill? Determine the number of 178 kN capacity trucks required to transport the excavated soil? [7M]

UNIT-IV

7 a) A saturated soil stratum 4 m thick lies above an impervious stratum and below a pervious stratum. It has a void ratio of 1.50 at an initial pressure of 150 kN/m^2. [7M]

i) Compute the change in void ration due to an increase in stress of 50 kN/m^2. Take Cc=0.20.

ii) Also compute the final settlement of the soil stratum due to above increase in stress.

b) Discuss the Terzaghi's spring analogy for primary consolidation. What are its uses? [7M]

Or

8 a) In a consolidation test, an increase of 100 kN/m^2 in the vertical pressure was applied to a saturated clay sample initially 2.5 cm thick. The thickness of the sample reduced to 2.46 cm after 24 hours. The sample was then relieved of pressure and allowed to take up water. The final thickness was 2.465 cm and the moisture content was 30%. Assuming that the sample was saturated throughout the test, calculate the following: [7M]

i) The initial void ratio (Take G=2.68)
ii) The void ratio after consolidation
iii) The void ratio after expansion
iv) The coefficient of compressibility

b) Describe the consolidometer test. Show how the results of this test are used to predict the rate of settlement and magnitude of settlement. [7M]

UNIT – V

9 a) Define earth pressure at rest. Show the earth pressure distribution on a retaining wall, assuming the soil is dry. [7M]

b) What inclination is required where a filling 12 m high is to be constructed having a factor of safety 1.25? The soil has c= 20 kN/m^2, ϕ= 15^o, γ=17 kN/m^3. The stability number for ϕ_m =12^o is equal to 0.063 when the slope is 30^o and 0.098 when the slope is 45^o. [7M]

Or

10 a) A retaining wall has vertical smooth back and is 8 m high. It supports a cohesionless soil with γ=19 kN/m^3 and ϕ=30^o. The surface of the soil is horizontal. Determine the thrust on the wall. [7M]

b) What are the different factors of safety used in stability of slopes? Discuss various methods for improving the stability of slopes. [7M]