

**II B. Tech II Semester Regular Examinations, June/July - 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**

**UNIT – I**

- 1 a) Give the soil classification chart with all the conditions mentioned as per Indian Standard Soil Classification System. [7M]
- b) A sand deposit consists of two layers. The top layer is 2.5 m thick ( $\gamma=1709.7 \text{ kg/m}^3$ ) and the bottom layer is 3.5 m thick ( $\gamma_{\text{sat}}= 2064.52 \text{ kg/m}^3$ ). The water table is at a depth of 3.5 m from the surface and the zone of capillary saturation is 1 m above the water table. Draw the total, neutral and effective stress diagrams for the given soil condition. [7M]

**Or**

- 2 a) Classify the following soils using Unified Soil Classification System. Give the group symbols and the group names. [7M]

Soil	Sieve Analysis, %finer		Liquid limit %	Plastic limit %	$C_u$	$C_c$
	4.75 mm	0.075 mm				
1	70	30	33	12	-	-
2	100	2	-	NP	7.2	2.2
3	48	20	41	19	-	-
4	88	78	69	31	-	-

- b) In a deposit of fine sand the water table is 3 m below the ground surface but the sand up to a height of 1 m above the water table is saturated by capillary water. The sand above this height may be considered dry. For the sand,  $G_s= 2.68$  and  $n= 40\%$ . Calculate the effective stress at a depth of 8 m. [7M]

**UNIT – II**

- 3 a) A uniformly distributed pressure of  $200 \text{ kN/m}^2$  is transferred by a square footing  $2\text{m} \times 2\text{m}$  at the ground surface. Construct an isobar for  $\sigma_z = 20 \text{ kN/m}^2$ . [7M]
- b) A concentrated load of 40 kN acts on the surface of a soil. Determine the vertical stress increment at points directly beneath the load up to a depth of 10 m and draw a plot. Also plot the variation of vertical stress increment due to load on horizontal planes at depths of 1m, 2m and 3m up to a horizontal distance of 3m on either side of center. [7M]

**Or**

- 4 a) A concentrated load of 50 kN acts on the surface of a homogenous soil mass of large extent. Determine the stress intensity at a depth of 5m, directly under the load and at horizontal distances of 0.5, 1, 1.5, 2 and 2.5 m. Plot the variation with distance. [7M]
- b) Compare the Westergaard's and Boussinesq's theory of vertical stresses. [7M]



## UNIT – III

- 5 a) A series of consolidated-undrained tests was conducted on an over-consolidated clay and the following results were obtained. [7M]

Sample No.	Cell pressure (kN/m <sup>2</sup> )	Deviator stress (kN/m <sup>2</sup> )	Pore-water pressure (kN/m <sup>2</sup> )
1	125	510	-70
2	250	620	-10
3	500	850	+120

Plot the strength envelopes in terms of total stress and effective stresses, and hence determine the strength parameters.

- b) What are the factors influencing compaction of soils. Explain the effect of any three factors in detail. [7M]

Or

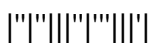
- 6 a) Compare the suitability of direct shear test and the triaxial test conditions on a given soil. [7M]
- b) An earthen embankment of  $10^6 \text{ m}^3$  volume is to be constructed with a soil having a void ratio of 0.80 after compaction. There are three borrow pits marked A, B and C, having soils with void ratios of 0.90, 1.50 and 1.80 respectively. The cost of excavation and transporting the soil is Rs.0.25, Rs.0.23 and Rs.0.18 per  $\text{m}^3$ , respectively. Calculate the volume of soil to be excavated from each pit. Which borrow is the most economical? ( $G_s = 2.65$ ) [7M]

## UNIT – IV

- 7 a) A 3 m thick clay layer beneath a building is overlain by a permeable stratum and is underlain by an impervious rock. The coefficient of consolidation of the clay was found to be  $0.025 \text{ cm}^2/\text{minute}$ . The final expected settlement for the layer is 8cm. (i) How much time will it take for 80% of the total settlement to take place? (ii) Determine the time required for a settlement of 2.5 cm to occur, (iii) Compute the settlement that would occur in one year. [7M]
- b) Explain the procedure adopted for determination of consolidation parameters using oedometer in the laboratory. [7M]

Or

- 8 a) For a normally consolidated clay specimen, the following data are obtained from a laboratory consolidation test. [7M]  
 $e_1 = 1.10, \sigma_1' = 65.0 \text{ kN/m}^2, e_2 = 0.85, \sigma_2' = 240.0 \text{ kN/m}^2$   
 i. Find the compression index  $C_c$ .  
 ii. Determine the void ratio at the end of consolidation when the next pressure increment raises the pressure to  $460.0 \text{ kN/m}^2$ ?
- b) Explain the effect of soil type and role of stress history on the compressibility of a soil, with proper graphs wherever required. [7M]



## UNIT – V

- 9 a) Give the assumptions of Rankine's earth pressure theory. Also derive an expression for passive pressure. [7M]
- b) An infinite slope consists of 5 m of soil lying on top of a bedrock. The bedrock and the soil surface are both inclined at  $23^\circ$  to the horizontal. The soil properties are:  
 $\gamma = 18.5 \text{ kN/m}^3$ ,  $c' = 15 \text{ kN/m}^2$  and  $\phi' = 20^\circ$ . Assume that the slope is dry.
- Obtain the maximum shear stress developed within the soil.
  - Calculate the maximum shear strength available within the soil.
  - Determine the factor of safety for the slope.

**Or**

- 10 a) A retaining wall has a vertical back and is 8 m high. The back face of the wall is smooth and the upper surface of the fill is horizontal. Determine the thrust on the wall per unit length. Take  $c = 10 \text{ kN/m}^2$ ,  $\gamma = 19 \text{ kN/m}^3$  and  $\phi = 20^\circ$ . Neglect tension. [7M]
- b) What are different types of slope failures? State the assumptions made in the analysis of stability of slopes. [7M]

