Reg. No.												

Question Paper Code	12711

B.E. / B.Tech. - DEGREE EXAMINATIONS, APRIL / MAY 2024

Fourth Semester

Civil Engineering

20CEPC403 - SOIL MECHANICS

Regulations - 2020

Duration: 3 Hours | Max. Marks: 100

PART - A (10 × 2 = 20 Marks)

Answer ALL Questions

		Marks	K – Level	CO
1.	Estimate the capillary rise in a soil with a void ratio of 0.60 and an effective size of 0.01mm. Take C = 15mm^2	2	K2	CO2
2.	The coefficient of permeability if a soil sample is found to be 0.09mm/s at a void ratio of 0.45. Estimate its permeability at a void ratio of 0.63	2	K2	CO2
3.	A raft foundation carries an udl of 300kN/m2. Estimate the vertical pressure at a depth of 9m. From Newmark's chart, the no. of influence areas counted as 62.	2	K2	CO3
4.	What will be the value of time factor, if the degree of consolidation is 40%?	2	K2	CO3
5.	What is the pole of a Mohr's circle?	2	K1	CO4
6.	Write down the Mohr – Coulomb failure envelope equation.	2	K1	CO4
7.	What is the effect of pore pressure on shear strength of soils?	2	K1	CO5
8.	Write down the expression to determine the shear strength of soil by vane shear test.	2	K1	CO5
9.	What is meant by base failure? When does it occur?	2	K1	CO6
10.	What do you mean by tension crack?	2	K1	CO6

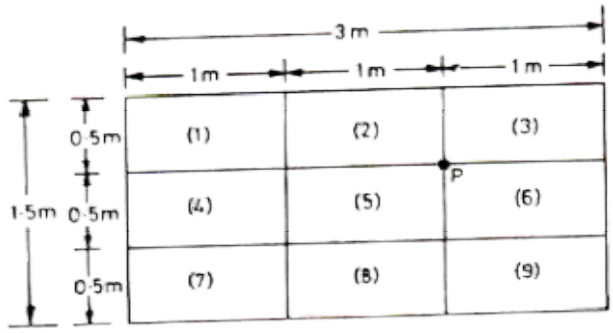
PART - B (5 × 13 = 65 Marks)

Answer ALL Questions

			Marks	K – Level	CO
11.	a)	The water table in a certain area is at a depth of 4m below the ground surface. To a depth of 12m, the soil consists of very fine sand having an average void ratio of 0.7. Above the water table, the sand has an average degree of saturation of 50%. Calculate the effective pressure on a horizontal plane at a depth of 10m below the ground surface. What will be the increase in effective pressure, if the soil gets saturated by capillary up to a height of 1m above the water table? Take G = 2.65.	13	K3	CO2
		OR			
	b)	A falling head permeability test was carried out on a 15cm long sample of silty clay. The diameter of the sample and the stand pipe were 9.8cm and 0.75cm respectively. The water level in the stand pipe	13	K3	CO2

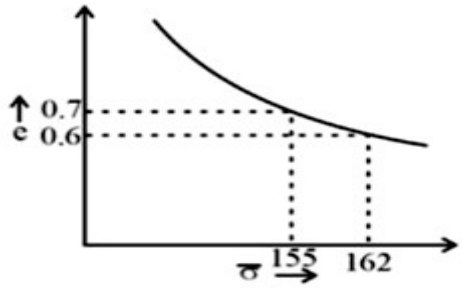
was observed to fall from 60cm to 45cm in 12 min.
Determine:
(i) Co-efficient of permeability of the soil.
(ii) Height of water level in the stand pipe after another 20min.
(iii) Time required for the water level to drop to 10cm.

12. a) A rectangular foundation 3.0×1.5m carries a uniform load of $40kN/m^2$. Determine the vertical stress at P which is 3m below the ground surface. Use equivalent point load method. *13 K3 CO3*



OR

b) i) A plot of e – σ' is shown as below, Calculate the co-efficient of compressibility. *4 K3 CO3*



ii) A normally consolidated clay settled 10mm, when effective stress was increased from 50 kPa to 100 kPa. If the effective stress would have been increased further by 100 kPa, then calculate the expected settlement of clay. *9 K3 CO3*

13. a) Explain Mohr's coulomb failure theory. Derive the relation between principal stresses at failure and shear strength parameters. *13 K2 CO4*

OR

b) In a vane shear test conducted in a soft clay deposit failure occurred at a torque of 42 N-m. Afterwards the vane was allowed to rotate rapidly and the test was repeated in the remoulded soil. The torque at failure in the remolded soil was 17 N-m. Calculate the sensitivity of the soil. In both cases, the vane was pushed completely inside soil. The height of vane and diameter across blades are 100mm and 80mm respectively. *13 K3 CO4*

14. a) Explain in detail with neat sketches about tri-axial shear test conducted in laboratory along with its merits and demerits. *13 K2 CO5*

OR

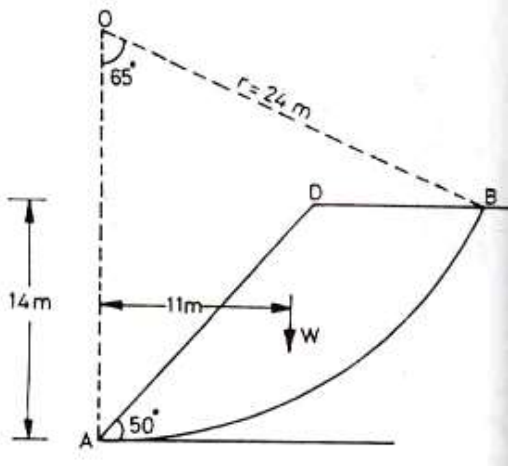
b) In a consolidated undrained tri-axial test, a soil sample was consolidated under a cell pressure of 200kPa and a back pressure of 100kPa for 24hrs. Afterwards the drainage path was closed and the cell pressure was increased to 300kPa. The pore pressure developed in the sample was found to be 8kPa. The back pressure was then gradually increased. Failure of the sample occurred, when the back pressure reached 450kPa. The pore pressure recorded at failure was 50 kPa. Determine the Skempton's pore pressure parameters A and B. *13 K3 CO5*

15. a) What will be the factor of safety with respect to average shearing strength, cohesion an internal friction of soil, for which the shear strength parameters obtained from the laboratory tests are c = 32 kN/m^2 and φ = 18°; the expected parameters of mobilized shearing resistance are c_m = 21 kN/m^2 and φ_m = 13° and the average effective pressure on the failure plane is 110 kN/m^2? Also for the same value of mobilized shearing resistance, determine the following:
a) Factor of safety with respect to height.
b) Factor of safety with respect to friction when that with respect to cohesion is unity.
c) Factor of safety with respect to strength. *13 K3 CO6*

OR

b) i) Explain how factor of safety is obtained for a finite slope made of purely cohesive soil by total stress method. *5 K2 CO6*

ii) An unsupported slope is shown in figure. Determine the factor of safety against sliding for trial slip surface. Take C = 50 kPa and φ = 0. The weight of the wedge ABD is 2518 kN and acts at a horizontal distance of 11m from the vertical AO. *8 K3 CO6*



PART - C (1 × 15 = 15 Marks)

16. a) The following are the data obtained in a shrinkage limit test: *15 K3 CO1*
Initial weight of saturated soil = 95.6g
Initial volume of saturated soil = 68.5cc
Final dry volume = 24.1cc
Final dry weight = 43.5g
Determine the shrinkage limit, specific gravity of solids, initial and final dry unit weight, bulk unit weight and void ratio.

OR

b) An embankment having total volume of 2000m^3 is to be constructed having a bulk density of 1.98g/cc and a placement water content of 18%. The soil is to be obtained either from borrow area A or borrow area B, which have void ratio of 0.78 and 0.69 respectively and water content of 16% and 12% respectively. Take G =2.66 for both the soils. Determine the volume of soil required to be excavated from each of the areas. If the cost of excavation is Rs.35 per m^3 in each area, but cost of transportation is Rs.32 and Rs.36 per m^3 from areas A and B respectively, which of the borrow area is more economical? *15 K3 CO1*