CBCS SCHEME

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BCV502

Fifth Semester B.E./B.Tech. Degree Examination, June/July 2024
Geotechnical Engineering

Time: 3 hrs. Max. Marks: 100

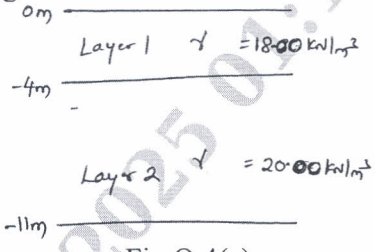
Note: 1. Answer any FIVE full questions, choosing ONE full question from each module.
2. M : Marks , L: Bloom's level , C: Course outcomes.

		Module – 1	M	L	C
Q.1	a.	With neat sketch of 3 phase system of soil. Explain dry soil, partially saturated soil and fully saturated soil.	6	L1	CO1
	b.	Derive the relationship: $WG = S_r e$	6	L2	CO1
	c.	A fully saturated sample has water content of 25% and unit weight of 20kN/m^3. Calculate: i) Dry unit weight ii) Specific gravity iii) Porosity iv) Unit weight, when degree of saturation is 80%.	8	L3	CO1
		OR			
Q.2	a.	Explain the different types of soil structures with neat sketch.	4	L2	CO1
	b.	Explain IS plasticity chart with neat sketch.	6	L2	CO1
	c.	In a sieve analysis test, the weight retained on each sieve is as given below, classify the soil.	10	L2	CO1

Soil type	A	B
% passing through 75 μm sieve	4%	52%
% passing through 4.75 mm sieve	74%	36%
D_{10} mm	0.40	
D_{30} mm	1.00	
D_{60} mm	2.00	
Liquid limit (W_L)	-	75%
Plastic limit (W_P)	-	30%

		Module – 2			
Q.3	a.	Explain Darcy's law with assumptions and limitations.	6	L2	CO4
	b.	List and explain factors affecting permeability of soil.	6	L2	CO4
	c.	A permeameter of diameter 75 mm contains a column of fine sand 400 mm long. When water flows through under constant head at the rate of 60 ml in 60 sec, the loss of head between two points 250 mm apart is 375 mm. Determine the coefficient of permeability (k). If a variable head test is made on the same soil sample using a stand pipe of diameter 30 mm. Estimate the time required for the water level in the stand pipe to fall from 1600 to 1560 mm above the outflow level.	8	L3	CO4

OR

Q.4	**a.**	What is meant by total stress, neutral stress and effective stress?	**6**	**L1**	**CO2**
	b.	What is flow net? Mention its applications.	**6**	**L2**	**CO2**
	c.	For the soil deposit shown below, draw the total stress, pore water pressure and effective stress diagrams. Assume the water table is at ground level.  Fig.Q.4(c)	**8**	**L3**	**CO2**

Module – 3

Q.5	**a.**	Differentiate between standard proctor test and modified proctor test.	**6**	**L2**	**CO2**
	b.	What are the effects of compaction on soil properties? Explain.	**6**	**L1**	**CO2**
	c.	The following data was obtained from a proctor compaction test: Water content (%): 5.90, 7.50, 9.7, 11.65, 13.85 Weight of wet sample (N): 18.20, 19.50, 20.10, 20.00, 19.70 Assume G = 2.7, volume of mould = 9.5×10^{-4} m^3. Plot the compaction curve. Determine OMC and MDD. Also plot Zero Air voids line.	**8**	**L3**	**CO2**

OR

Q.6	**a.**	Explain the concept of consolidation by mass spring analogy.	**6**	**L2**	**CO2**
	b.	Explain the Terzaghi's consolidation theory with its limitations.	**6**	**L2**	**CO2**
	c.	The time to reach 40% consolidation of a two way drained laboratory 12 mm thick saturated clayey soil sample is 40 sec. Determine the time required for 60% consolidation of the same soil of 10 m thick on the top of a rocky surface subjected to the same loading conditions as laboratory sample.	**8**	**L3**	**CO2**

Module – 4

Q.7	**a.**	Explain assumptions of Mohr's strength theory and mention its limitations.	**6**	**L2**	**CO3**
	b.	Explain the factors affecting shear strength of soil.	**6**	**L2**	**CO3**
	c.	An unconfined compression test was conducted on an undisturbed sample of clay. The sample had a diameter of 38 mm and was 80 mm long. The load at failure measured as 30 N and the axial deformation of the sample at failure was 12 mm. Determine the unconfined compressive strength and undrained shear strength of clay, if failure angle = 50°.	**8**	**L3**	**CO3**

OR

Q.8	**a.**	Briefly explain different drainage conditions of triaxial shear test.	6	L2	CO3
	b.	Mention any 4 advantages of triaxial shear test.	4	L1	CO3
	c.	A consolidated undrained test was carried out on a clayey sample and the results are as follows. Find total and effective shear parameters of soil. (see table below)	10	L3	CO3

Cell pressure, kN/m^2	100	200	400	600
Deviator stress, kN/m^2	300	410	610	850
Pore water pressure, kN/m^3	-45	-15	50	110

Module – 5

Q.9	**a.**	Explain the assumptions of Terzaghi's bearing capacity theory.	6	L2	CO4
	b.	Differentiate between general shear failure, local shear failure, punching shear failure.	6	L2	CO4
	c.	What will be the gross and net safe bearing pressure of sand having $\phi = 40°$, unit weight of sand = 19 kN/m^3 under i) 1.2 m wide strip footing ii) 1.2 m square footing. Assume the footings are placed at a depth of 1.2 m below G.L and water table is at greater depth. Also assume F.O.S. = 3 and $N_c = 95.7$, $N_q = 81.3$, $N_y = 100.4$.	8	L3	CO4

OR

Q.10	**a.**	Differentiate immediate settlement, consolidation and secondary settlements.	6	L2	CO4
	b.	Give the tolerance limits as per BIS specifications for total and differential settlements for footing and rafts.	8	L2	CO4
	c.	A clayey stratum of 5 m thick has a unit weight of 15 kN/m^3 water content of 43% liquid limit = 80%, specific gravity G = 2.7. Initial overburden pressure due to old structure is 300 kN/m^2, due to construction of a building stress increased to 120 kN/m^2. Determine the consolidation settlement.	6	L3	CO4

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