

CBCS SCHEME

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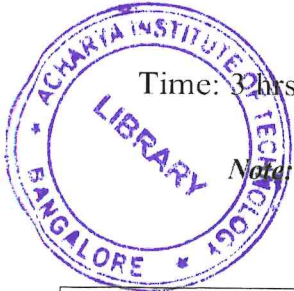
BCV502

Fifth Semester B.E./B.Tech. Degree Examination, June/July 2026

Geotechnical Engineering

Time: 3 hrs.

Max. Marks: 100



- Notes:**
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.	Define : i) Void ratio ii) Porosity iii) Degree of saturation iv) Water content v) Dry unit weight		5	L1	CO1
	b.	With usual notations, derive the relationship : $S_e = W G$		5	L3	CO1
	c.	The volume of an undistributed clay sample having water content of 40% is $25.6 \times 10^{-6} \text{ m}^3$ and its weight is 0.435 N. Calculate the void ratio and degree of saturation of sample. Given $G = 2.75$.		10	L4	CO1
OR						
Q.2	a.	Write a detailed note on IS classification.		10	L2	CO1
	b.	Differentiate between the K_{QO} linite, Illite and Montmorillonite clay minerals with neat sketches.		10	L2	CO1
Module – 2						
Q.3	a.	Explain the determination of coefficient of permeability by constant head or falling head method.		8	L2	CO2
	b.	Define : i) Coefficient of permeability ii) Discharge velocity iii) Seepage velocity		6	L2	CO2
	c.	Determine the average coefficient of permeability in the horizontal and vertical directions for a deposit consisting of 3 layers of thickness 5 m, 1 m and 2.5 m and having coefficients of permeability of $3 \times 10^{-2} \text{ mm/sec}$, $3 \times 10^{-5} \text{ mm/sec}$ and $4 \times 10^{-2} \text{ mm/sec}$ respectively.		6	L4	CO2

OR

Q.4	a.	What is a Flownet? Explain the characteristics and uses of flownets.	10	L2	CO2
	b.	A clay structure of thickness 4 m is located at a depth of 6 m below the ground surface, it is overlayed by fine sand, the water table is located at a depth of 2 m below ground surface. For fine sand, submerged unit weight is 10.2 kN/m^3 . The moist unit weight of sand located above water table is 16 kN/m^3 . For clay layer $G = 2.76$ and $W = 25\%$. Compute the effective stress at the middle of clay layer.	10	L4	CO2

Module – 3

Q.5	a.	Write the test procedure of standard proctors compaction test.	8	L2	CO3														
	b.	The following results were obtained from a standard compaction test as a sample of soil: <table><tr><td>Water content (%)</td><td>0.12</td><td>0.14</td><td>0.16</td><td>0.18</td><td>0.20</td><td>0.22</td></tr><tr><td>Mass of wet soil (kg)</td><td>1.68</td><td>1.85</td><td>1.91</td><td>1.87</td><td>1.87</td><td>1.85</td></tr></table> The volume of mould used was 950 ml plot compaction curve and calculate the r_{dmax} and OMC. Also calculate the void ratio and degree of saturation at OMC.	Water content (%)	0.12	0.14	0.16	0.18	0.20	0.22	Mass of wet soil (kg)	1.68	1.85	1.91	1.87	1.87	1.85	12	L4	CO3
Water content (%)	0.12	0.14	0.16	0.18	0.20	0.22													
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OR

Q.6	a.	Write the assumptions of Terzaghi's 1-D consolidation theory.	6	L2	CO3
	b.	Determination the pre consolidation pressure by Casagrande's graphical method.	6	L2	CO3
	c.	In a consolidation test, when the load was changed from 50 to 100 kPa, the void ratio changed from 0.7 to 0.65. Determine the coefficient of volume, decrease in m_v and compression index c_c .	8	L4	CO3

Module – 4

Q.7	a.	How do you calculate shear strength parameters from Mohr-Columb theory?	6	L2	CO4												
	b.	Discuss about the factors affecting shear strength of sands and clays.	6	L2	CO4												
	c.	A direct shear test was conducted on soil and following results were obtained:<table><tr><th>Sample No.</th><th>Normal stress (kN/m²)</th><th>Shear stress (kN/m²)</th></tr><tr><td>1</td><td>15</td><td>18</td></tr><tr><td>2</td><td>30</td><td>25</td></tr><tr><td>3</td><td>45</td><td>32</td></tr></table> Determine the cohesion and angle of shearing resistance.	Sample No.	Normal stress (kN/m ²)	Shear stress (kN/m ²)	1	15	18	2	30	25	3	45	32	8	L4	CO4
Sample No.	Normal stress (kN/m ²)	Shear stress (kN/m ²)															
1	15	18															
2	30	25															
3	45	32															

OR

Q.8	a.	List the different methods to measure the shear strength of soil. Explain any one of them.	6	L2	CO4
	b.	Explain the advantages of triaxial shear over direct shear test.	6	L2	CO4
	c.	A cylindrical specimen of saturated clay 40 mm in diameter and 80 mm in length is tested in an unconfined compression test. Find shear strength of clay, if the specimen fails under an axial load of 350 N. The change in length of specimen @ failure is 8 mm. Also find the shear parameters if the angle made by the failure plane with horizontal is 50° .	8	L4	CO4

Module – 5

Q.9	a.	State the factors influencing bearing capacity of soil.	4	L2	CO5
	b.	Distinguish between General shear failure and Local shear failure.	4	L2	CO5
	c.	A foundation 2.0 m square is at 1.2 m below ground level in sandy soil with unit weight of 19.2 kN/m^3 above water table and submerged unit weight of 10.1 kN/m^3 . If $C = 0$ and $\phi = 30^\circ$. Find ultimate bearing capacity when : i) Water table is much below the base of foundation ii) Water table rises to the foundation iii) Water table rises to ground level. Take $N_q = 22$ and $N_r = 20$	12	L4	CO5

OR

Q.10	a.	Explain importance and concept of settlement analysis.	6	L2	CO5
	b.	State the factors influencing the settlement of foundation soil.	4	L2	CO5
	c.	Determine the settlement for saturated clay 8 m thick underlies a proposed new building. The existing overburden pressure at centre of clay layer is 300 kPa and load due to new building increases pressure by 200 kPa. The liquid limit of soil is 75%. Water content of soil is 50% and $G_s = 2.7$.	10	L4	CO5
