

**PRAGATI ENGINEERING COLLEGE: SURAMPALEM**  
**(AUTONOMOUS)**  
**III B.Tech I Semester Supplementary Examinations, May - 2024**  
**GEOTECHNICAL ENGINEERING**  
**(Civil Engineering)**

Time: 3 hours

Max. Marks: 70 M

Answer ONE Question from each Unit  
 All Questions Carry Equal Marks

Q. No.	Questions	BTL	CO	Marks
<b>UNIT – I</b>				
1.	a) Explain different types of soil structures	K2	C01	7 M
	b) A sample of saturated soil has a volume $100\text{cm}^3$ and mass of $210\text{gm}$ . When the soil was completely dried out, the volume of the sample was $90\text{cm}^3$ and its mass was $174\text{gm}$ . Compute i) the initial moisture contents ii) shrinkage limit iii) specific gravity of soil	K3	C01	7 M
<b>OR</b>				
2.	a) The Atterberg limits of a clay soil are: Liquid limit = 75%; Plastic limit = 45%; and Shrinkage limit = 25%. If a sample of this soil has a volume of $30\text{ cm}^3$ at the liquid limit and a volume $16.6\text{ cm}^3$ at the shrinkage limit, determine the specific gravity of solids, shrinkage ratio, and volumetric shrinkage.	K3	C01	7 M
	b) Explain procedure of Hydrometer test and limitations	K2		7 M
<b>UNIT – II</b>				
3.	a) A bed of sand consists of three horizontal layers of equal thickness. The magnitude of the coefficient of permeability for both the upper and lower layer is $7 \times 10^{-5}\text{ mm/s}$ and for the middle layer is $3 \times 10^{-3}\text{ mm/s}$ . Determine the ratio of the average permeability of the bed in the horizontal direction to that in the vertical direction?	K3	C02	7 M
	b) Calculate total and effective stress at a depth of 4m and 8m below the ground surface. Water table is at a depth of 4m below the ground. Moisture content above the water table is 10%. Take $G=2.67$ , $e=0.65$ .	K3	C02	7 M
<b>OR</b>				
4.	a) A soil profile consists of a top layer of sand 3m thick and $\gamma=17\text{kN/m}^3$ , an intermediate clayey silt layer 2m thick and $\gamma_{\text{sat}}=15\text{kN/m}^3$ and a bottom layer of gravel 4m thick and $\gamma_{\text{sat}}=19\text{kN/m}^3$ . The water table is at the top of clayey silt layer. calculate the effective stress at 5m and 9m from ground surface	K3	C02	7 M
	b) Explain characteristics and uses of flow net	K2	C02	7 M
<b>UNIT – III</b>				

5.	a)	Determine vertical stress at a radial distance of 3m and at a depth of 6m when a concentrated load of 120kN acts on the surface of a soil. Use Boussinesq's theory and Westergaard's theory.	K3	C03	7 M														
	b)	Explain 2:1 stress distribution method.	K2	C03	7 M														
OR																			
6.	a)	Explain the construction procedure of New mark's Influence Chart for irregular areas with a neat sketch	K2	C03	7 M														
	b)	A ring foundation is of 3.0 m external diameter and 2.0 m internal diameter. It transmits a uniform pressure of 90.0 kN/m <sup>2</sup> . Calculate the vertical stress at a depth of 1.50 m directly beneath the centre of the loaded area.	K3	C03	7 M														
UNIT – IV																			
7.	a)	A 20mm thick oedometer clay sample reaches 40% consolidation in 12minutes with drainage at top and bottom. The clay layer from which this sample was obtained had one-way drainage with 8m thick. Estimate, how long would it take the clay layer to reach 90% consolidation?	K3	C04	7 M														
	b)	Explain field compaction control by proctor's needle method	K2	C04	7 M														
OR																			
8.	a)	<div>A proctor compaction test was conducted on a soil sample, and the following observations were made:<table border="1"><tr><td>Water content, percent</td><td>7.7</td><td>11.5</td><td>14.6</td><td>17.5</td><td>19.7</td><td>21.2</td></tr><tr><td>Mass of wet soil, g</td><td>1739</td><td>1919</td><td>2081</td><td>2033</td><td>1986</td><td>1948</td></tr></table><div>If the volume of the mould used was 950 cm<sup>3</sup> and the specific gravity of soils grains was 2.65, make necessary calculations and draw, (i) compaction curve and (ii) 80% and 100% saturation lines</div></div>	Water content, percent	7.7	11.5	14.6	17.5	19.7	21.2	Mass of wet soil, g	1739	1919	2081	2033	1986	1948	K4	C04	7 M
	Water content, percent	7.7	11.5	14.6	17.5	19.7	21.2												
Mass of wet soil, g	1739	1919	2081	2033	1986	1948													
b)	A layer of soft clay is 6 m thick and lies under a newly constructed building. The weight of sand overlying the clayey layer produces a pressure of 260 kN/m <sup>2</sup> and the new construction increases the pressure by 100 kN/m <sup>2</sup> . If the compression index is 0.5, compute the settlement. Water content is 40% and specific gravity of grains is 2.65.	K3	C04	7 M															
UNIT – V																			
9.	a)	Discuss the practical significance of Mohr-Coulomb strength envelope?	K2	C05	7 M														

b)	A cylindrical specimen of a saturated soil fails under an axial stress $150 \text{ kN/m}^2$ in an unconfined compression test. The failure plane makes an angle of $52^\circ$ with the horizontal. Calculate the cohesion and angle of internal friction of the soil by Graphical or Analytical Approach.	K3	C05	7 M
----	---	----	-----	-----

**OR**

10.	The following data relate to a triaxial compression tests performed on a soil. Determine the total and effective stress parameters of the soil by using graphical method			K3	C05	14 M
	Test No	Cell pressure ( $\text{kN/m}^2$ )	Max. deviator stress ( $\text{kN/m}^2$ )			
	1	80	175			
	2	150	240			
	3	210	300			
			Pore pressure at maximum deviator stress ( $\text{kN/m}^2$ )			
			45			
			50			
			60			

