PVP 20

Code: 20CE3402

II B.Tech - II Semester – Regular / Supplementary Examinations
MAY - 2023

GEOTECHNICAL ENGINEERING
(CIVIL ENGINEERING)

Duration: 3 hours Max. Marks: 70

Note: 1. This paper contains questions from 5 units of Syllabus. Each unit carries 14 marks and have an internal choice of Questions.
2. All parts of Question must be answered in one place.

BL – Blooms Level CO – Course Outcome

* Assume the suitable data as per Indian Standards *

<table>
<tr><th></th><th></th><th></th><th>BL</th><th>CO</th><th>Max. Marks</th></tr>
<tr><td colspan="6">UNIT-I</td></tr>
<tr><td rowspan="2">1</td><td>a)</td><td>Define submerged density of soil. Deduce a relation between submerged density and saturated density.</td><td>L3</td><td>CO1</td><td>6 M</td></tr>
<tr><td>b)</td><td>The results of Sieve Analysis performed on soil are given below.
<table>
<tr><td>Sieve Size(mm)</td><td>4.75</td><td>2.36</td><td>1.18</td><td>0.6</td><td>0.3</td><td>0.15</td><td>0.075</td></tr>
<tr><td>Mass of soil retained (g)</td><td>66</td><td>31</td><td>35</td><td>55</td><td>50</td><td>65</td><td>60</td></tr>
</table>
The mass of dry sample taken for the test is 400g.
i. Draw the particle size distribution curve and list the percentages of gravel, sand, and Fines (Silt & Clay).
ii. Determine the uniformity coefficient and coefficient of curvature.</td><td>L4</td><td>CO1</td><td>8 M</td></tr>
<tr><td colspan="6">OR</td></tr>
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2	a)	A soil sample was collected from an embankment and obtained the following data: sample size 38 mm dia. × 76 mm height and had a bulk weight of 170.2 g, oven-dry weight of 145.5 g and Gs = 2.68. Determine water content, dry density, bulk density, void ratio, and degree of saturation.	L3	CO1	8 M
	b)	Discuss in detail about the significance of Atterberg limits of soils.	L2	CO1	6 M
		UNIT-II			
3	a)	A constructed flow net shows N_f=6 and N_d=16. The seepage velocity and hydraulic gradients are 0.001 cm/sec and 1:2500 respectively. A maximum of 8.0 m water level is allowed in the earthen dam. Compute the seepage loss of the dam. Also, draw a neat sketch for the same.	L3	CO2	7 M
	b)	A sand sample of 40 cm^2 cross sectional area and 18 cm long was tested in a constant head permeameter. Under a head of 60 cm, the discharge was 150 ml in 8 min. The dry weight of sand used for the test was 1150 g and Gs = 2.68. Determine the hydraulic conductivity (cm/sec), discharge velocity and the seepage velocity.	L3	CO2	7 M
		OR			
4	a)	Compute the total, effective and pore pressure at a depth of 20 m below the bottom of a lake 6 m deep. The bottom of lake consists of soft clay with a thickness of more than 20 m. The average water content of the clay is 35% and the specific gravity of the soil may be assumed to be 2.65.	L3	CO2	7 M
	b)	Determine the average coefficient of permeability in the horizontal and vertical directions for a deposit consisting of three layers of thickness 5m, 1m and 2.5m and having the coefficient of	L4	CO2	7 M

		permeability of 3 x 10^{-2} mm/sec, 3 x 10^{-5} mm/sec and 4 x 10^{-2} mm/sec respectively. Assume the layers are isotropic.			
		UNIT-III			
5	a)	The following are the results of the Modified compaction test results of Silty soil: Water content (%): 5.7, 9.5, 12.6, 14.5, 16.7, 18.8 Mass of dry soil (kg): 1.7, 1.90, 2.03, 1.99, 1.96, 1.92 If the volume of the mould was 970 cc and the specific gravity of solids was 2.67, find out the maximum dry density also plot 5% air voids line & 85% saturation line.	L4	CO3	7 M
	b)	Explain the theory of consolidation with the help of a diagram.	L2	CO3	7 M
		OR			
6	a)	What are the principles, purpose and affects of compaction?	L2	CO3	7 M
	b)	A sand fill compacted to a bulk density of 18.84 kN/m^3 is to be placed on a compressible saturated marsh deposit 3.5 m thick. The height of the sand fill is to be 3 m. If the volume compressibility of the deposit is 7×10^{-4} m^2/kN, estimate the final settlement of the fill.	L3	CO3	7 M
		UNIT-IV			
7	a)	A particular soil failed under a major principal stress of 300 kN/m^2 with a corresponding minor principal stress of 100 kN/m^2. If, for the same soil, the minor principal stress had been 200 kN/m^2, determine the major principal stress would have been if (i) $\varphi = 30°$ and (ii) $\varphi = 0°$	L3	CO4	7 M

<table>
<tr><td></td><td>b)</td><td>Describe the triaxial shear test. What are the advantages of triaxial shear test over direct shear test?</td><td>L2</td><td>CO4</td><td>7 M</td></tr>
<tr><td colspan="6">OR</td></tr>
<tr><td>8</td><td>a)</td><td>Dry sand samples were tested in a large shear box, 25 cm × 25 cm and the following results were obtained:
<table>
<tr><td>Normal Load (kN)</td><td>5</td><td>10</td><td>15</td></tr>
<tr><td>Peak shear load (kN)</td><td>5</td><td>10</td><td>15</td></tr>
<tr><td>Ultimate shear load (kN)</td><td>2.9</td><td>5.8</td><td>8.7</td></tr>
</table>
Determine the angle of shearing resistance of the sand in the dense and loose states.</td><td>L4</td><td>CO4</td><td>7 M</td></tr>
<tr><td></td><td>b)</td><td>The principal stresses at a point in a material are 80 kN/m^2 and 40 kN/m^2. Determine the normal, shear and resultant stresses on a plane inclined at 30^0 to the major principal plane. Find also for this plane, the maximum value of obliquity.</td><td>L4</td><td>CO4</td><td>7 M</td></tr>
<tr><td colspan="6">UNIT-V</td></tr>
<tr><td>9</td><td>a)</td><td>A concentrated load of 22.5 kN acts on the surface of a homogeneous soil mass of large extent. Evaluate the stress intensity at a depth of 15 meters and (i) directly under the load and (ii) at a horizontal distance of 7.5 meters. Use Boussinesq’s equations.</td><td>L3</td><td>CO5</td><td>8 M</td></tr>
<tr><td></td><td>b)</td><td>What will be the stress matrix at a point in the body?</td><td>L2</td><td>CO5</td><td>6 M</td></tr>
<tr><td colspan="6">OR</td></tr>
<tr><td>10</td><td>a)</td><td>What is Soderberg-GoodMan model, explain with neat sketch.</td><td>L3</td><td>CO5</td><td>7 M</td></tr>
<tr><td></td><td>b)</td><td>A concentrated load of 40 kN acts on the surface of a homogeneous soil mass of large extent. Find the stress intensity at a depth of 17 meters and (i) directly under the load and (ii) at a horizontal distance of 9.0 metres. Use Boussinesq’s equations.</td><td>L4</td><td>CO5</td><td>7 M</td></tr>
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