PVP 23

Code: 23CE3503

III B.Tech - I Semester - Regular Examinations - NOVEMBER 2025

GEOTECHNICAL ENGINEERING - I
(CIVIL ENGINEERING)

Duration: 3 hours Max. Marks: 70

Note: 1. This question paper contains two Parts A and B.
2. Part-A contains 10 short answer questions. Each Question carries 2 Marks.
3. Part-B contains 5 essay questions with an internal choice from each unit. Each Question carries 10 marks.
4. All parts of Question paper must be answered in one place.

BL – Blooms Level CO – Course Outcome

PART – A

		BL	CO
1.a)	Define Relative Density?	L1	CO1
1.b)	Write the relation between Air Content, Porosity and Percentage Air voids.	L1	CO1
1.c)	State Darcy's law and its limitations.	L1	CO2
1.d)	Define permeability.	L1	CO2
1.e)	What is Phreatic Line?	L1	CO3
1.f)	Define Total Stress.	L1	CO3
1.g)	Differentiate normally consolidated and over consolidated clays.	L2	CO4
1.h)	List the types of rollers used in compaction.	L2	CO4
1.i)	Explain Stress-Strain behavior of Sands.	L2	CO5
1.j)	Name the types of shear tests based on drainage conditions.	L2	CO5

PART – B

<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>2</td><td>a)</td><td>Derive the relation between e, S, G and w.</td><td>L3</td><td>CO1</td><td>5 M</td></tr>
<tr><td></td><td>b)</td><td>The plastic limit of soil is 30% and its plasticity index is 10%. When the soil is dried from its state to plastic limit, the volume change is 27% of its volume at plastic limit. Similarly, the corresponding volume change from the liquid limit to the dry state is 36% of its volume at liquid limit. Determine the shrinkage limit and the shrinkage ratio.</td><td>L3</td><td>CO1</td><td>5 M</td></tr>
<tr><td colspan="6">OR</td></tr>
<tr><td>3</td><td>a)</td><td>Explain with neat sketches types of soil structure.</td><td>L2</td><td>CO1</td><td>5 M</td></tr>
<tr><td></td><td>b)</td><td>The following results refer to a liquid limit test: The plastic limit is 23.5%. Determine the plasticity index and toughness index
<table>
<tr><td>No of blows</td><td>33</td><td>25</td><td>15</td><td>9</td></tr>
<tr><td>Water content (%)</td><td>41.5</td><td>49.5</td><td>52.5</td><td>57.5</td></tr>
</table></td><td>L3</td><td>CO1</td><td>5 M</td></tr>
<tr><td colspan="6">UNIT-II</td></tr>
<tr><td>4</td><td>a)</td><td>Write a short note on
i) seepage velocity
ii)coefficient of permeability
iii)quick sand condition.</td><td>L2</td><td>CO2</td><td>5 M</td></tr>
</table>

	b)	With the help of neat sketch, derive the equation to determine permeability by the falling head permeability test.	L3	CO2	5 M
OR					
5	a)	Determine the average coefficient of permeability in directions parallel and perpendicular to the planes of a stratified deposit of soil consisting of 3 layers of total thickness 3 m. The top and bottom layers are 0.5 m and 0.8 m thick. The values of K for top, middle and bottom layers are 2×10^{-4} cm/s, 3×10^{-3} cm/s, 1×10^{-2} cm/s respectively	L3	CO2	5 M
	b)	Explain the factors affecting the permeability of soil.	L2	CO2	5 M
UNIT-III					
6	a)	What is Flow net? Explain in detail with neat sketches.	L2	CO3	5 M
	b)	Write the expression for critical hydraulic gradient. Also, find the critical hydraulic gradient for soil having void ratio of 0.65 and specific gravity 2.72.	L3	CO3	5 M
OR					
7	a)	Derive the principle of construction of Newmark's chart.	L3	CO3	5 M
	b)	As per Boussinesq's theory, derive the expression for vertical stress at any point in a soil mass due to point load.	L3	CO3	5 M

UNIT-IV					
8	a)	List out all factors affecting Compaction.	L2	CO4	5 M
	b)	Explain in detail field compaction control methods.	L3	CO4	5 M
OR					
9	a)	Explain with spring analogy, Terzaghi's theory of one-dimensional consolidation.	L3	CO4	5 M
	b)	Define the following terms: i. Coefficient of compressibility ii. Coefficient of volume compressibility iii. Compression Index iv. Degree of consolidation	L1	CO4	5 M
UNIT-V					
10	a)	What are the factors affecting the shear strength of soil?	L2	CO5	5 M
	b)	What are the advantages and disadvantages of direct shear test over triaxial test?	L2	CO5	5 M
OR					
11	a)	A direct shear test was performed on a 6cm x 6cm sample of dry sand with normal load of 360N. The failure occurred at a shear load of 180N. Plot the Mohr's strength envelope and determine ϕ. Assume c=0.	L3	CO5	5 M
	b)	Explain about unconfined compressive strength (UCS). Also, draw stress strain behavior of clayey soil under UCS test.	L2	CO5	5 M