

JAYPEE UNIVERSITY OF INFORMATION TECHNOLOGY, WAKNAGHAT

TEST -3 EXAMINATIONS- 2026

B.Tech-IV Semester (CE)

COURSE CODE (CREDITS): 25B11CE411 (3)

MAX MARKS: 35

COURSE NAME: Geotechnical Engineering

COURSE INSTRUCTOR: Dr. Ashok Kumar Gupta

MAX. TIME: 2 Hours

Note: (a) All questions are compulsory.

(b) The candidate is allowed to make Suitable numeric assumptions wherever required for solving problems

(c) Use of calculator is allowed

Q.No	Question	CO	Marks														
Q1	A retaining wall 7 m high retains dry cohesionless backfill having: Unit weight of soil = 18.5 kN/m³, Angle of internal friction = 32°, & Saturated unit weight of soil = 21 kN/m³. Backfill surface carries a surcharge of 25 kPa. The back of wall is vertical and smooth. Determine: (a) Active earth pressure coefficient using Rankine theory, (b) Total active earth pressure due to soil only, (c) Additional lateral pressure due to surcharge, (d) Total active thrust and its point of application from base (e) If water table rises up to mid-height of wall, calculate revised active thrust.	3	7														
Q2	A soil sample was compacted in the laboratory using the Standard Proctor Test. The following results were obtained: <table><tr><th>Water Content (%)</th><th>Bulk Density (kN/m³)</th></tr><tr><td>6</td><td>16.8</td></tr><tr><td>9</td><td>18.2</td></tr><tr><td>12</td><td>19.4</td></tr><tr><td>15</td><td>20.1</td></tr><tr><td>18</td><td>19.6</td></tr><tr><td>21</td><td>18.9</td></tr></table> Determine: (a) Optimum Moisture Content (OMC) (b) Maximum Dry Density (MDD) (c) Dry density corresponding to each water content (d) Void ratio at MDD if specific gravity of soil solids $G_s = 2.70$ (e) Degree of saturation at OMC.	Water Content (%)	Bulk Density (kN/m ³)	6	16.8	9	18.2	12	19.4	15	20.1	18	19.6	21	18.9	4	7
Water Content (%)	Bulk Density (kN/m ³)																
6	16.8																
9	18.2																
12	19.4																
15	20.1																
18	19.6																
21	18.9																
Q3	A soil deposit consists of three horizontal layers of sand and silt as shown below: <table><tr><th>Layer</th><th>Thickness (m)</th><th>Coefficient of Permeability, k (cm/s)</th></tr><tr><td>Top</td><td>3</td><td>4×10^{-3}</td></tr><tr><td>Middle</td><td>2</td><td>1×10^{-4}</td></tr></table>	Layer	Thickness (m)	Coefficient of Permeability, k (cm/s)	Top	3	4×10^{-3}	Middle	2	1×10^{-4}	4	7					
Layer	Thickness (m)	Coefficient of Permeability, k (cm/s)															
Top	3	4×10^{-3}															
Middle	2	1×10^{-4}															

	Bottom 5 Determine: (a) The equivalent coefficient of permeability in the horizontal direction, (b) The equivalent coefficient of permeability in the vertical direction (c) Comment on the difference between the two values.	6×10^{-3}		
Q4	Derive the expressions for normal stress and shear stress acting on a plane inclined at an angle θ anticlockwise to the major principal plane, when vertical stresses act on the major and minor principal planes. What is the value of maximum shearing stress? Also, construct the corresponding Mohr's Circle using the derived stress values.		5	7
Q5	A vertical retaining wall of height 6.5 m retains a saturated clayey soil having the following properties: Unit weight of saturated clay, $\gamma = 18 \text{ kN/m}^3$, Cohesion, $c = 22 \text{ kPa}$, & Angle of internal friction, $\phi = 0^\circ$. Determine: (a) Active earth pressure coefficient, K_a , (b) Lateral pressure intensity at the top and bottom of the wall, (c) Depth of tension crack, (d) Total active earth pressure acting on the wall, (e) Point of application of the resultant force from the base of wall.		5	7