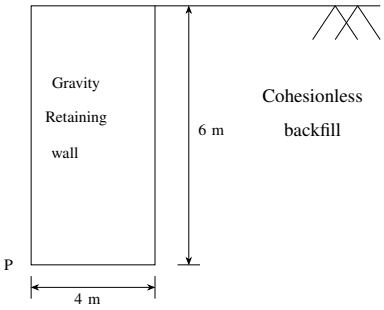
GATE-2016-CE

AI24BTECH11025-P.L.Kushal

40) The porosity n and the degree of saturation S of a soil sample are 0.7 and 40%, respectively. In a 100 m^3 volume of the soil, the volume (expressed in m^3) of air is _____.

41) A homogeneous gravity retaining wall supporting a cohesionless backfill is shown in the figure. The lateral active earth pressure at the bottom of the wall is 40 kPa.



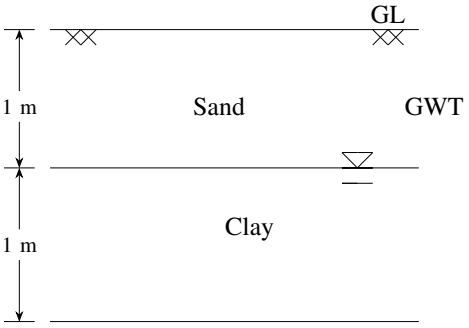
The minimum weight of the wall (expressed in kN per m length) required to prevent it from overturning about its toe (Point P) is

a) 120 b) 180 c) 240 d) 360

42) An undisturbed soil sample was taken from the middle of a clay layer (i.e., 1.5 m below GL), as shown in figure. The water table was at the top of clay layer. Laboratory test results are as follows:

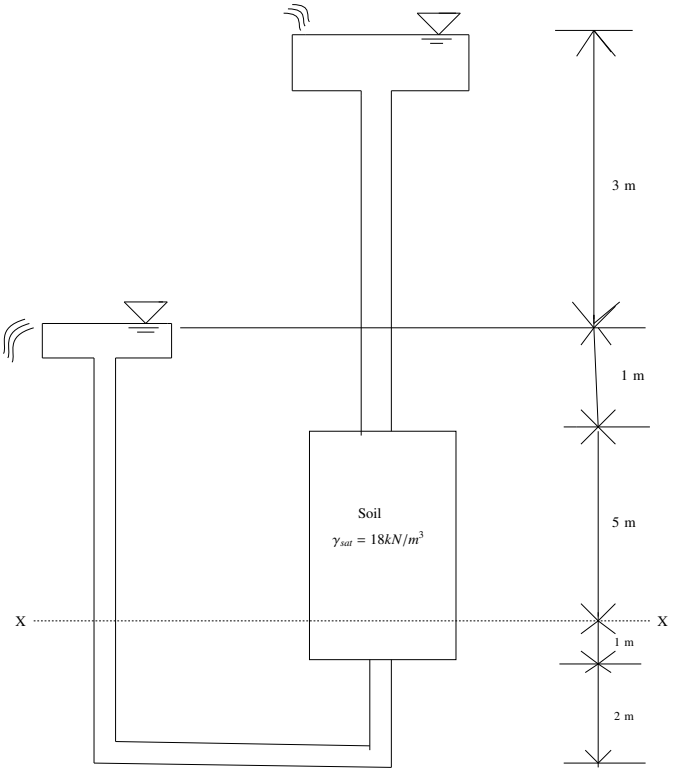
Natural water content of clay	25%
Preconsolidation pressure of clay	60 kPa
Compression index of clay	0.50
Recompression index of clay	0.05
Specific gravity of clay	2.70
Bulk unit weight of sand	17 kN/m^3

A compacted fill of 2.5 m height with unit weight of 20 kN/m^3 is placed at the ground level.



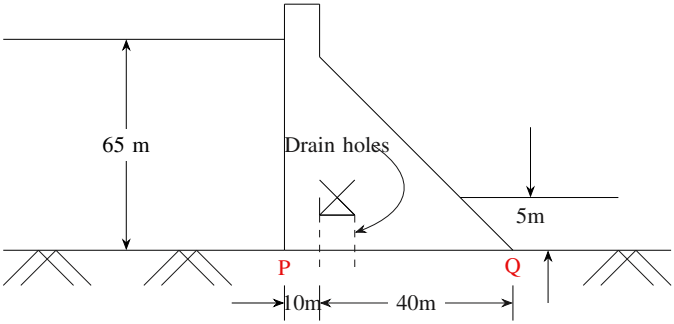
Assuming unit weight of water as 10 kN/m^3, the ultimate consolidation settlement (expressed in mm) of the clay layer is _____.

43) A seepage flow condition is shown in the figure. The saturated unit weight of the soil γ_{sat} = 18 kN/m^3. Using unit weight of water, γ_w = 9.81 kN/m^3, the effective vertical stress (expressed in kN/m^2) on plane X-X is _____.

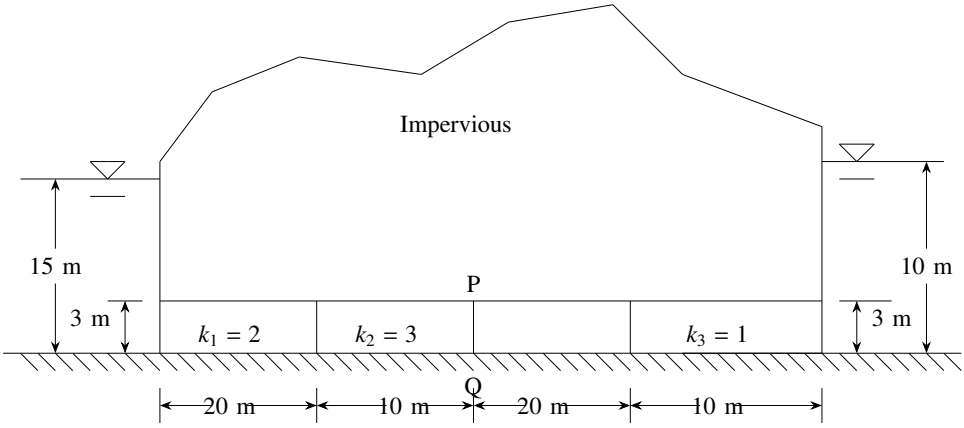


44) A drained triaxial compression test on a saturated clay yielded the effective shear strength parameters as $c' = 15\,\text{kPa}$ and $\phi' = 22°$. Consolidated Undrained triaxial test on an identical sample of this clay at a cell pressure of 200 kPa developed a pore water pressure of 150 kPa at failure. The deviator stress (expressed in kPa) at failure is _____.

45) A concrete gravity dam section is shown in the figure. Assuming unit weight of water as 10 kN/m^3 and unit weight of concrete as 24 kN/m^3, the uplift force per unit length of the dam (expressed in kN/m) at PQ is _____.



46) Seepage is occurring through a porous media shown in the figure. The hydraulic conductivity values k_1, k_2, k_3 are in m/day. The seepage discharge (m^3/day per m) through the porous media at section PQ is



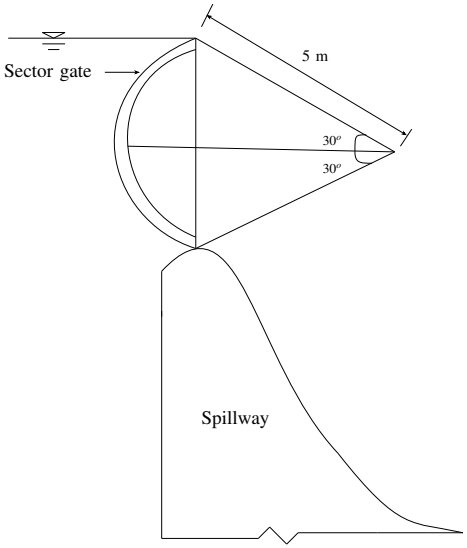
a) $\frac{7}{12}$ b) $\frac{1}{2}$ c) $\frac{9}{16}$ d) $\frac{3}{4}$

47) A 4 m wide rectangular channel, having bed slope of 0.001 carries a discharge of 16 m^3/s. Considering Manning's roughness coefficient = 0.012 and $g = 10\,\text{m/s}^2$, the

category of the channel slope is (A) horizontal (B) mild (C) critical (D) steep.

a) horizontal b) mild c) critical d) steep

48) A sector gate is provided on a spillway as shown in the figure. Assuming $g = 10\,\text{m/s}^2$, the resultant force per meter length (expressed in kN/m) on the gate will be _____.



49) A hydraulically efficient trapezoidal channel section has a uniform flow depth of 2 m. The bed width (expressed in m)

50) Effluent from an industry 'A' has a pH of 4.2. The effluent from another industry 'B' has double the hydroxyl (OH) ion concentration than the effluent from industry 'A'. pH of effluent from the industry 'B' will be _____.

51) An electrostatic precipitator (ESP) with $5600m^2$ of collector plate area is 96 percent efficient in treating 185 m^3/s of flue gas from a 200 MW thermal power plant. It was found that in order to achieve 97 percent efficiency, the collector plate area should be 6100 m^2. In order to increase the efficiency to 99 percent, the ESP collector plate area (expressed in m^2) would be _____.

52) The 2-day and 4-day BOD values of a sewage sample are 100 mg/L and 155 mg/L, respectively. The value of BOD rate constant (expressed in per day) is _____.