

# Exam Type Questions

Retaining Walls

# Question 1

A retaining wall is constructed to support a soil embankment. The wall has a height of 6 m and retains soil with a unit weight ( $\gamma$ ) of 19 kN/m<sup>3</sup>. The backfill soil is level, and the soil has a friction angle ( $\phi$ ) of 32°.

- (a) Determine the active earth pressure coefficient ( $K_a$ ) using Rankine's theory.
- (b) Calculate the active earth pressure ( $p_a$ ) acting on the wall.
- (c) If the water table rises to 2.5 m below the surface, and the saturated unit weight of soil ( $\gamma_{\text{sat}}$ ) is 21 kN/m<sup>3</sup>, compute the total thrust ( $P_a$ ) exerted on the wall.

## Question 2

A retaining wall is constructed to support a 5.5 m high soil embankment. The backfill soil has a unit weight ( $\gamma$ ) of 18.8 kN/m<sup>3</sup> and an internal friction angle ( $\phi$ ) of 31°. The surface of the backfill is level.

- (a) Determine the Rankine active earth pressure coefficient ( $K_a$ ).
- (b) Calculate the active earth pressure ( $p_a$ ) exerted on the wall.
- (c) If the water table rises to 2.2 m below the ground surface and the saturated unit weight ( $\gamma_{\text{sat}}$ ) is 20.5 kN/m<sup>3</sup>, compute the total thrust ( $P_a$ ) acting on the wall.

## Question 3

A 4.5 m high retaining wall supports a soil embankment. The soil behind the wall has a unit weight ( $\gamma$ ) of 17.5 kN/m<sup>3</sup> and an internal friction angle ( $\phi$ ) of 28°. The backfill is level.

- (a) Compute the active earth pressure coefficient ( $K_a$ ) using Rankine's theory.
- (b) Determine the active earth pressure ( $p_a$ ) acting on the wall.
- (c) If the water table rises to 2 m below the ground surface and the saturated unit weight of soil ( $\gamma_{\text{sat}}$ ) is 19.5 kN/m<sup>3</sup>, calculate the total thrust ( $P_a$ ) acting on the wall.

# Exam Type Questions

Overtopping



# Question 1

A 1:3 smooth ( $r = 1.0$ ) sloping seawall has a toe at 0 mCD, a still water level at 2.8 mCD, and a crest level of 4.8 mCD.

Estimate the overtopping discharge when the significant wave height ( $H_s$ ) = 3.5 m and the mean wave period ( $T_m$ ) = 6.8 s using Owen's Method.



## Question 2

A 1:4 smooth ( $r = 1.0$ ) sloping seawall has a toe at 0.5 mCD, a still water level at 2.6 mCD, and a crest level of 5.0 mCD.

Determine the overtopping discharge when the significant wave height ( $H_s$ ) = 4.2 m and the mean wave period ( $T_m$ ) = 8.0 s using Owen's Method.



## Question 3

A 1:1.5 smooth ( $r = 1.0$ ) sloping seawall has a toe at 0 mCD, a still water level at 3.0 mCD, and a crest level of 4.5 mCD.

Calculate the overtopping discharge when the significant wave height ( $H_s$ ) = 3.8 m and the mean wave period ( $T_m$ ) = 7.2 s using Owen's Method.

# Exam Type Questions

Groundwater Contamination



# Question 1

An industrial waste spill has contaminated the groundwater near a landfill site. A nearby well, located 800 metres downstream, is used for drinking water.

Given the following information:

Hydraulic Conductivity of Soil ( $k$ ) = 4 m/day

Kinematic Porosity of Soil ( $n$ ) = 12%

Change in Water Level (Head Difference) ( $\Delta h$ ) = 3 m

Use Darcy's Law to determine how long it will take for the contaminants to reach the well.



## Question 2

A fuel leakage from an underground storage tank has seeped into the groundwater. A municipal water supply well is located 1.2 km downstream from the leak.

Given the following information:

Hydraulic Conductivity of Soil ( $k$ ) = 6 m/day

Kinematic Porosity of Soil ( $n$ ) = 14%

Change in Water Level (Head Difference) ( $\Delta h$ ) = 2.5 m

Use Darcy's Law to determine the time it will take for the contaminants to reach the water supply well.



## Question 3

A pesticide spill at a farm has led to groundwater contamination. A river located 900 metres downstream is at risk of contamination.

Given the following data:

Hydraulic Conductivity of Soil ( $k$ ) = 5.2 m/day

Kinematic Porosity of Soil ( $n$ ) = 10%

Change in Water Level (Head Difference) ( $\Delta h$ ) = 1.8 m

Use Darcy's Law to calculate the time required for the pollutants to reach the river.