# FINAL EXAM

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Sec : "A"

Subject : Geo-tech Engineering

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QNO: 01

Part: A

Force Acting on Dam:

The Following Force acting on Dam.

1. Water pressure
2. Earthquake force.
3. Silt pressure
4. uplift pressure
5. Wave pressure
6. Self weight of Dam
7. Ice pressure

1. Water Pressure: It is one of The major external force acting on Dam. The horizontal water pressure exerted by The water Stored on upstream Side of The Dam It Can be Calculated by Hydrostatic pressure distribution.

OR

It is The pressure of water That acts perpendicular on The upstream Face of The dam.

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(2) Earthquake pressure :

Dynamics Loads produced due to earthquakes must be Considered in The design of all major Dams Located in a high Risks Seismic zones. Earthquakes Creates waves in every possible directions However It has to be Resoloved into vertical and horizontal for The designing purpose of The dam. The horizontal Component has high effect.

(3) Silt Pressure :

~~The weight of Dam~~

The Silt gets deposited against the upstream face of the dam It has been explained under "Reservoir Sedimentation"

→ It Can be Calculated by The following formula

$P_{silt} = 0.5 \gamma_s h^2 K_a$

where,

h = height of Silt deposited

$K_a$ = Co-efficient of active earth pressure of silt which is equal $\frac{1 - \sin\phi}{1 + \sin\phi}$

$\phi$ = Angle of internal fraction of Soil

$\gamma_s$ = Submerged unit weight of silt Material

P-T-O-

(4) Uplift pressure:

water Seeping Through The pores, Cracks and fissures of The foundation material It enters Through the dam body and then f to the bottom Through The joints between the body of the dam It is also The major external force and must be ~~accu~~ Considered for an all calculation. uplift pressure virtually Reduce The downward weight of The body of the dam and hence acts against The dam stability.

(5) Ice pressure:-

The Ice which can be formed on the water Surface of The reservior in the Cold Countries may Sometime melt and expand The dam face is Subjected to Thrust and exerted by The expanding ~~a~~ ice This force act linearly along The length of The dam and at The Reservior Level.

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Q : 01

**Part : B** Define The following :

① Liquification of Soil :

It is a phenomenon in which The Strength and Stiffiness of Soil is Reduced by earthquake Shaking or others Repaid forces.

② Butress Dam :-

A butress Dam or hollow Dam is a dam with a Solid Water tight upstream Side that is Supported at interval on The downstream Side by The Sires of butress or Support. The Dam wall may be Straight or Curved

③ Infinite Slope :

It is used to designate a Constant Slope of infinite extend. The Long slope of the face of mountain.

P-T-O

(4) Pier Foundation:
It Consist of Cylindrical Coloumn of Large diameter to Support and transfer Large Super-imposed Loads to firm Straate. It is preferred in a Location where top strate Consist of decomposed rock overlying a strate of Sound rock

→ The peir foundation transfer the Load only Through bearing. ~~and~~

(5) Dynamic Load:
It is a time varying Load in nature. ~~becau~~

→ Load Can be accelerated or deaccelerated

→ Example of Dynamic Load are Live-Load(L.L) wind-Load or quick Load and Snow-Load

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Q No: 02 :

part A : Shallow Foundation:

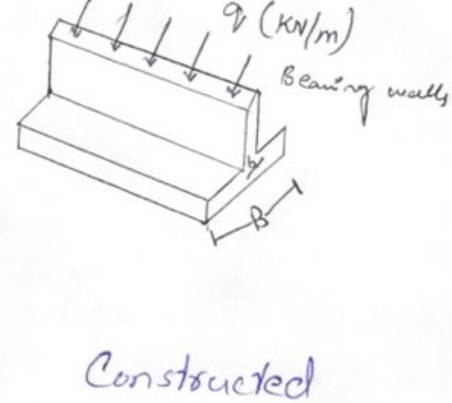
when the width of Foundation is greater than the depth of Foundation is Called Shallow foundation.

Types of Shallow foundation:

Following are the types of Shallow Foundation.

① Wall / strip footing:

Wall footing / strip footing is a Footing which runs across the Length of the Footing




② Combined footing:-

Footing which Constructed Combined for two or more Columns to transfer the Load of these Colums Safety to the Soil then Such footing is Called Combined

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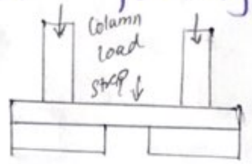
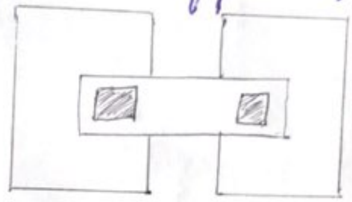
(3) Strapped footing:

footing in which the outer Column is Connected with the inner Column by means of tie beam or Strap Such a footing is Called Strapped footing

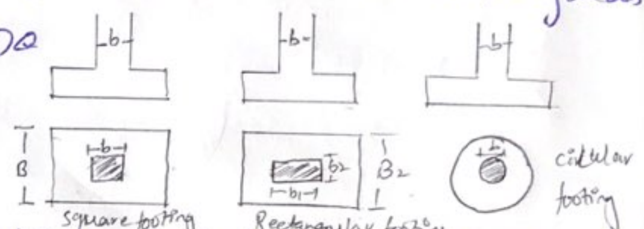


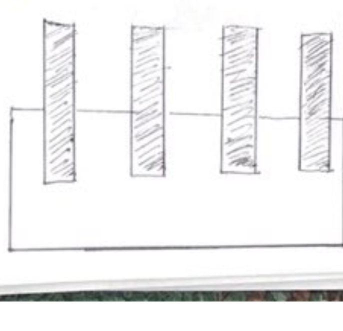
(4) Isolated footing / Column:

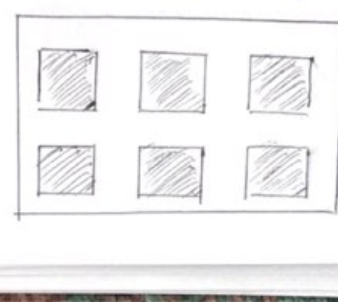
footing which is Constructed for a Single Column and transfer its Load Safely to the Soil is Called Column.

→ This Column may be Circular Rectangular or Square in Shape




(5) Raft/Mat footing: Footing which is Constructed &covers the area of the entire structure. This type of footing is provided when the Soil is weak in bearing mean having weak bearing Capacity.





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(08)

Q No: 2
Part: B

Importance of ground Improvement techniques:

The Soil in which volometric Change Take place due to Shrinkage and Swelling Such soil needs ground improvement techniques.

→ The Soil which is organic in nature

→ The soft Soil also required ground improvement techniques,

Methods of Ground Improvement Techniques:

① Removal And Replacement of Soil:

This is an oldest and Simple Method. This method is performed on Loose Soil.

In This Method the unsuitable Soil is replaced with Compacted fill. in This Method the Same Soil is used to refill. the higher Compaction and better engineering properties.

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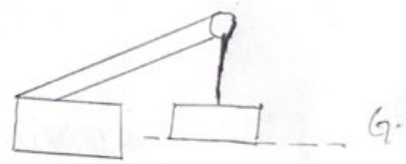
(2) Dynamic Compaction:

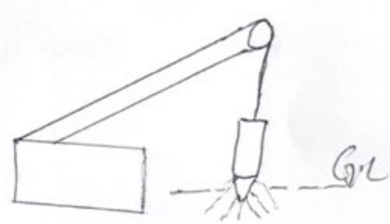
This Method is used to increase the bearing Capacity of Soil. This method also increase the density of Soil. In this method actually densification of Soil take place.

(3) VIBRO Compaction:




It is also called vibro densification. In this method the Compaction take place at a Certain depth in granular soil through vibratory probe. This vibratory probe is run by an electric motor. The penetration of probe is enhance by ejecting water at the tip of probe.

(4) Rapid Impact Compaction:




Impact energy is applied to surface of ground as a result of which densification of soil take place. →

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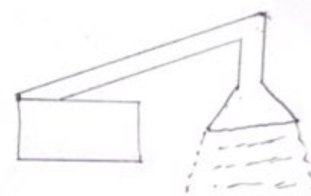
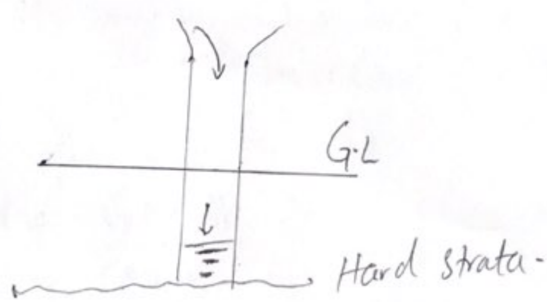
upto a depth of 15 feet.

This impact energy is actually applied through hydraulic ramp. The hydraulic ramp weight values from 4-8 tons.



(5) VIBRO Concrete Coloumns:-

Vibro Concrete Colamns is a ground improvement technique which transfer the load from weak strata to hard strata by using strength concrete.

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**QNO: 03** :

Given data :

$C = 25\ kN/m^2$

$\phi = 16^0$

$G = 2.72$

$e = 0.50$

Required:

(1) Factor of Safety ($F_c$) when Soil is dry

(2) " " " " when soil is seepage in Soil.

Solution:

(1) $$F_c = \frac{c}{\gamma_d + H + \sin i \times \cos i} + \frac{\tan\phi}{\tan i}$$

where,

$$\gamma_d = \frac{G_s \times \gamma_w}{1 + e}$$

$$\gamma_d = \frac{2.72 \times 9.8}{1 + 0.5}$$

$\gamma_d = 17.77\ kN/m^3$

Say, $\gamma_d = 17.8\ kN/m^3$

P.T.O →

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putting the values

$$F_c = \frac{25}{17.8 \times 6 \times \sin(26^\circ) \times \cos(26^\circ)} + \frac{\tan(16^\circ)}{\tan(26^\circ)}$$

$$= 0.5941 + 0.587$$

$$\boxed{F_c = 1.181}$$

(2) Seepage of water:

$$F_c = \frac{c}{\gamma \times H \times \sin i \times \cos i} + \frac{\gamma'}{\gamma} \times \frac{\tan \phi}{\tan i}$$

Now,

$$\gamma' = \gamma - \gamma_w$$

$$\gamma = \frac{G + e}{1 + e} \times \gamma_w$$

$$= \frac{2.72 + 0.5}{1 + 0.5} \times 9.8$$

$$\gamma = 21.037 \ KN/m^3$$

Say,

$$\gamma = 21.04 \ KN/m^3$$

$$\gamma' = \gamma - \gamma_w$$

$$= 21.04 - 9.8$$

$$\gamma' = 21.24 \ KN/m^3$$

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putting values

$$F_c = \frac{25}{21.04 \times 6 \times \sin(26^\circ) \times \cos(26^\circ)} + \frac{11.24}{21.04} \times \frac{\tan(16^\circ)}{\tan(26^\circ)}$$

$$= 0.502 + 0.534 \times 0.587$$

$$F_c = 0.8159$$

say,

$$\boxed{F_c = 0.816}$$ Ans

**QNO: 04:**

**Part: A**

Given Data:

Height, H = 10m

$C = 18.8\ KN/m^2$

$\gamma = 17\ KN/m^3$

$\phi = 20^\circ$

F.o.s = 1.5

$F_\phi = 1.0$

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Required Inclination, $i = ?$

Solution:

we know that

$$S_N = \frac{C}{F.os \times \gamma \times H}$$

by putting values

$$S_N = \frac{18.8}{1.5 \times 17 \times 10}$$

$S_N = 0.073$

Using taylor Chart for the following data:

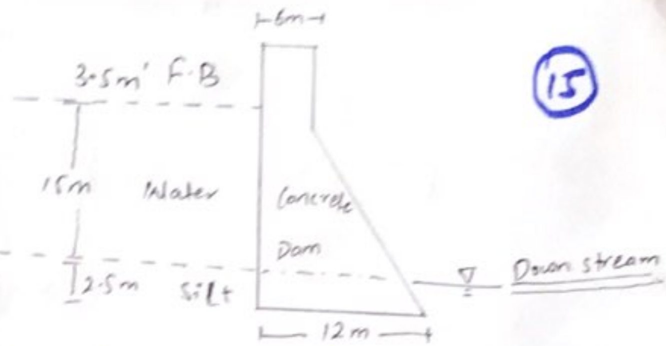
$\phi = 20^\circ$

$S_N = 0.073$

$i = 44^\circ$

**Q: 04**

**Part: B**




(15)

Given data:

→ Height of water on upstream.S = 15m
→ Bottom width of the dam = 12m
→ Top width = 6m
→ Unit weight of wate = 1000kg/m³
→ Unit weight of Concrete = 1450kg/m³
→ Unit weight of Silt = 1330kg/m³
→ Angle of friction for the Silt = $\phi_s = 35°$
→ Free board = 3.5m
→ Silt Deposite height = 2.5m

Required:

Silt pressure ($P_{silt}$) = ?

Solution:

Formula for Silt pressure

$$P_{silt} = 0.5 \gamma_s h^2 K_a \longrightarrow (1)$$

To find the value of $K_a$

$$K_a = \frac{1 - \sin 35°}{1 + \sin 35°} = \frac{1 - 0.57}{1 + 0.57}$$

$$\boxed{K_a = 0.27}$$

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$\gamma_{subw}$ = Submerged unit weight of Silt material

$G_s = \frac{\gamma_s}{\gamma_w}$ = $\frac{\text{Unit wt of Soil solid}}{\text{Unit wt of water}}$

$G_s = 1.33$

$\gamma_{unit\ weight\ saturated} = \gamma_w \left( \frac{G_s + e}{1+e} \right)$

$\gamma_{saturated} = 1000 \left( \frac{1.33 + 0.65}{1 + 0.65} \right)$

Consider

As Loose angular - grained Silty Sand $e = 0.65$

$\gamma_{saturate} = 1000 \left( \frac{1.98}{1.65} \right)$

$\gamma_{saturated} = 1200 \, Kg/m^3$

Submerged Silt $\gamma_{sub} = \gamma_{sat} - \gamma_w$

$= 1200 - 1000$

$\gamma_{submerged} = 200 \, Kg/m^3$

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Now

$$P_{silt} = \frac{1}{2} \gamma_{sub} w h^2 Ka$$

$$P_{silt} = \frac{1}{2} 200 \times (2.5 in)^2 \times 0.27$$

$$P_{silt} = 0.5 \times 200 \times 6.25 \times 0.27$$

$$P_{silt} = 168.75$$

**Pressure of Silt = 169 kg/m²**

THE END