Final term paper:

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| Section | A |
| Subject | Geotech & Foundation Engg |
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## Q:-1 Net Forces acting on Dam:-

Ans: Diffrent types of forces act on Dam Structure:

1- **Water Pressure:-**

In Pressure of water that acts perpendicular on the upstream face of the dam. pressure Component on both upstream & down stream are

① Vertical Component
② Horizontal Complonent.

② **Ice Pressure:-**

The Ice which may be formed on the water Surface of the reservior in Cold Countries may Sometimes melt & Expand.

→ Expansion & Contraction occure due to temperature variations.

⇒ Co-efficient of thermal Expansion of Ice is 5 times more then Concrete.

3- <u>Wave Pressure:-</u>

waves are generated on the Surface of reservior by blowing winds. which exert a pressure on the upper part the dam above the water level. pressure can be calculated as $P_w = 2.4\gamma_w h_w$.

4- ~~the~~ <u>Self weight of the Dam:-</u>

The weight of the dam body and its foundation is the major resisting force.

⇒ Generally unit length of dam is considered.

⇒ The total weight w of the dam act at the C.G of its Section.

5- Seismic or Earthquack forces:-

An Earth quack produce waves which are Capable of shaking the dam in every possible direction. Earthquakk waves may move in any direction and for design purpose, it has to be resolved in vertical & horizonatal Component.

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Question - 01 part B

1- Liquification of Soil:-

Effective Stresses are the stresses which keep the soil particals in Contact with each other if the effective stresses decrease the soil loose its strength. when the effective stresses become zero then soil will change to liquified state.

2- Buttress Dam:-

A Buttress or hollow dam is basically

a derivation of a gravity dam with the Introduction of intermediate space.

⇒ This Dam usess Buttresses to transfer the force of the water to the foundation.

⇒ It require less Concrete to construct then gravity Dam.

3- <u>Infinite Slope:-</u>

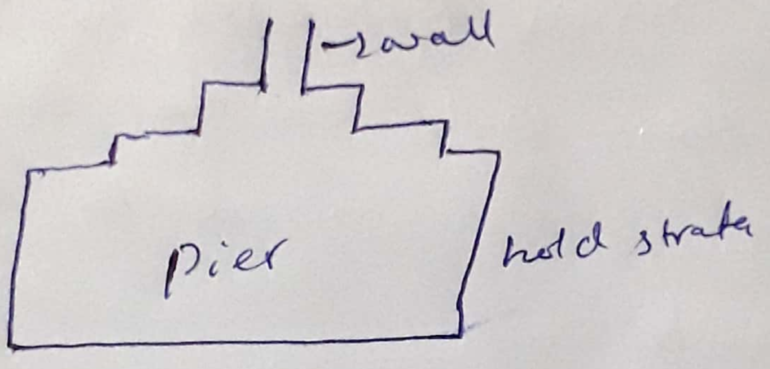
The Slop which have finite area and depth Such a type of Slop is called Infinit Slop.

⇒ The boundaries of these Slopes are not well defined.

For example Natural Slop i.e, Hills, deserts.

4- <u>Pier foundation:-</u>

The vertical member which have Larger dia as compared to pile & transmit the load of Structure to the underground Soil. They are constructed by cast-In-Situ process.




5- Dynamic load:-

Dynamic load vary in their magnitude direction or position with time.

⇒ Due to dynamic load the settelment chances may increase.

⇒ Dynamic load may be in the form of

→ Earthquake
→ operation of heavy machinary
→ wave motion
→ wind.

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## Question = 2 part "A"

### Shallow Foundation:-

- **According to tarzaghi:-**

The foundation in which depth of foundation is less as equal to width of the foundation is called shallow foundation.

$D_f \leq B$.

- **According to Skemption:-**

The foundation in which $D_f/B$ ratio is less then as equal to 2.5 the the foundation is called Shallow foundation.

### Types of Shallow foundation:

1- wall Footing:-

The footing which runs accross the length of the wall and transfer

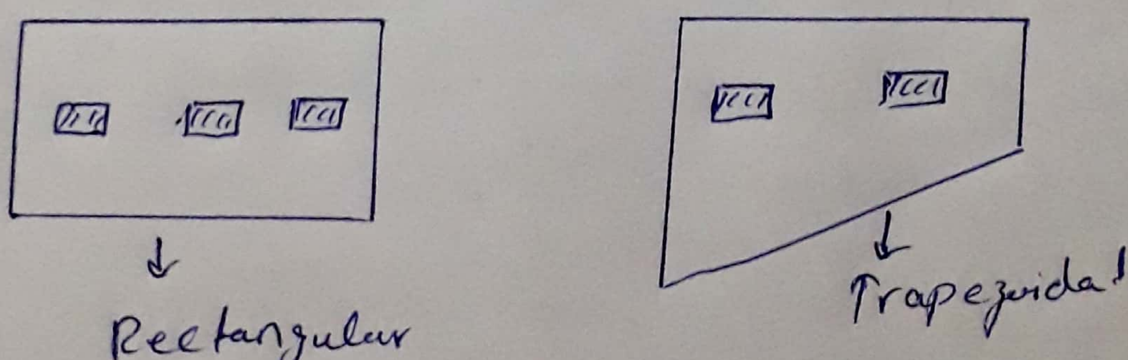
The load of the wall to the Soil Safely. It is called wall footing.

2- <u>Combined footing:-</u>

The footing which is constructed for two or more column and transfer the load of the two as mere column to the Soil Safely then its is called Combined footing.

⇒ If the load of Column ⇒ Uniform ⇒ Rectangular footing

⇒ If Load of column ⇒ non-uniform
↓
Trapezoidal footing.

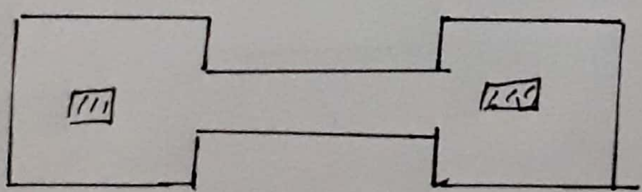


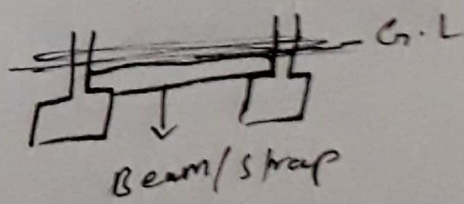
3/ Raft / Mat footing :-

The footing which covers the whole area of the structure is called Raft footing. This type of footing is proposed in weak bearing capacity soil area.

4 - Strapped footing :-

The footing in which the outers column is connected with the inners column by means of the beam or strap is called strapped footing.

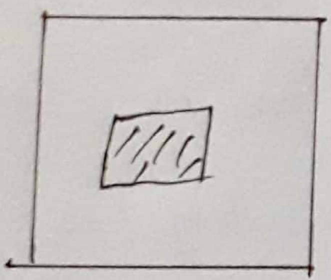




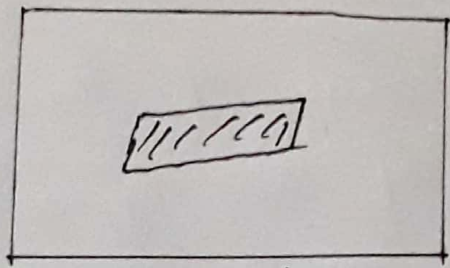

5 - Column / Isolated footing :-

The footing which is constructed for a single column and transmit its load to soil safely. It may be

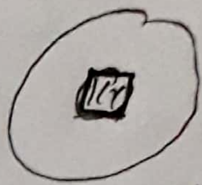
Circular, Square, Rectangular in Shape



Square



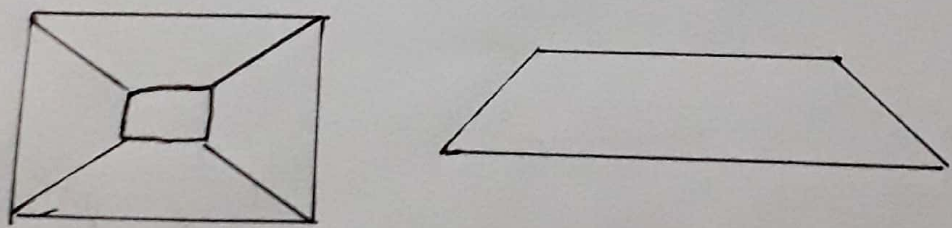
rectangular



Circular.

6- <u>Slopped Footing:-</u>

The footing which have slop in all direction or in all sides is called slopped footing.



Question: 2 part B)

## Importance of ground improvement techniques.

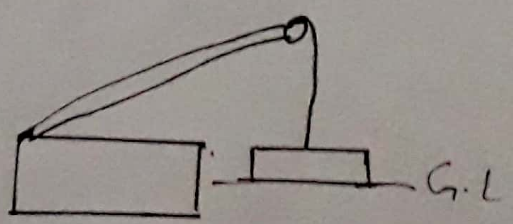
The Soil in which volumetric changes take place due to shrinkage and swelling Such Soil need ground improvement technique.
- The soil which is organic in nature.
- Soft Soil and sandy Soil also need ground improvement techniques.

## Methods of Ground improvent Techniques.

### 1- Removal & replacement of soil:-

This is an oldest and Simple method. this method is perform on loose Soil. In this method the Unsuitable Soil is replaced with Compacted fill.

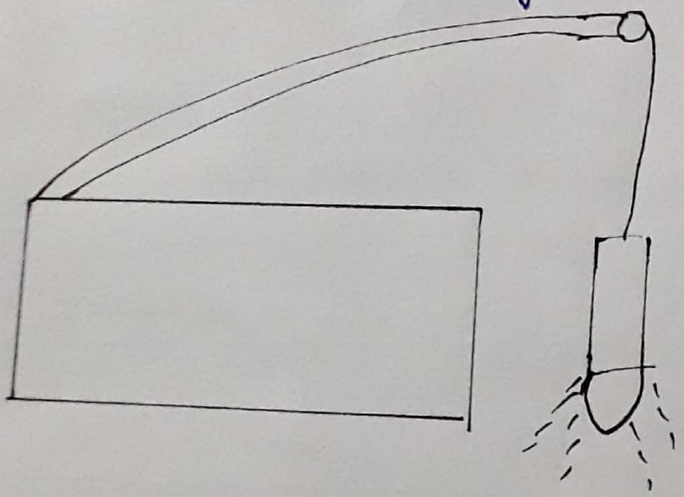
### 2. Dynamic Compaction:-




This method is used to increase the bearing Capacity of soil. This is also increase the Consolidation rate.

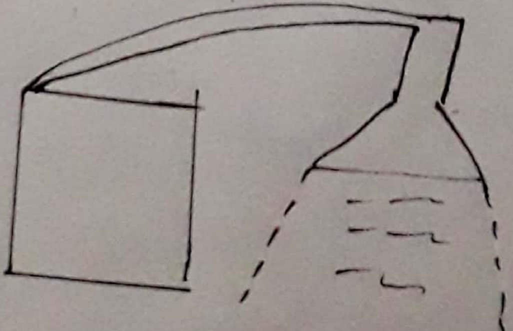
3- VIBRO Compaction:-

It is also called vibro densification. In this method the compaction be takes place at a certain depth in granular soil through vibratory probe. This probe is run by electric motor.



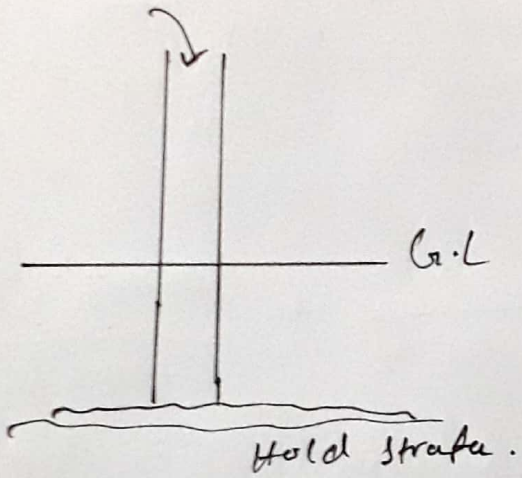
4- Rapid Impact Compaction:-

Impact energy is applied to surface of ground as a result of which densification of soil take place upto a depth of 15 feet.



5- <u>VIBRO Concrete Column:-</u>

Vibro Concrete Columns is a ground improvement technique which trans fer the load from weak Strata to hold Strata by using Strength Concrete.




## Question # 3 /

Given data:-

$C = 25\ kN/m^2$

$\phi = 16^\circ$

$G = 2.75$

$e = 0.50$

$i = 26^\circ$

$F_c$ = FOS when Soil is dry = ?

$F_c$ = F.O.S when there is seepage in soil => ?

Solution:-

$$F_c = \frac{c}{\gamma_d \times H_r \times \sin i \times \cos i} + \frac{\tan \phi}{\tan i}$$

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

$$\boxed{\gamma_d = 17.8 \ kN/m^3}$$

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

$\boxed{F_c = 1.18}$ → when soil is dry

when there is seepag of water

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

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

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

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

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

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

$$\gamma' = 21.04 - 9.8$$

$$\gamma' = 11.24 \ kN/m^3$$

So

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

$F_c = 0.816$ when Seepage in soil

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Question # 4 :- Part "A"

Given data :

$H = 10m$

$c = 18.8\ kN/m^2$

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

$\phi = 20^\circ$

$FOS = 1.5$

$F_\phi = 1.0$

Inclination $= i = ?$

Solution :

$$S_N = \frac{c}{FOS \times \gamma \times H} = \frac{18.8}{1.5 \times 17 \times 10} = 0.073$$

$S_N = 0.073$

Now using Taylor chart:

$\phi = 20^\circ$

$SN = 0.073$

$\boxed{i = 44^\circ}$ → From Taylor chart.

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## Q4 Part B/

Given data:

- → Height of water on upstream Side = 15m
- → Bottom width of the dam = 12 m
- Top width = 6m
- → Unit wt of water = 1000 kg/m$^3$
- → Unit wt of Concret = 1450 kg/m$^3$
- → Unit weight of Silt = 1330 kg/m$^3$
- → $\phi = 35^\circ$
- → Free Board = 3.5m
- → Silt Deposit height = 2.5m

Silt pressure = ?

Solution:

Silt pressure $= \frac{\gamma_s \times H_s^2}{2} \times \frac{1 - \sin\phi}{1 + \sin\phi}$

$= \frac{1330 \times (2.5)^2}{2} \times \frac{1 - \sin 35^{\circ}}{1 + \sin 35^{\circ}}$

**Silt pressure $= P_s = 1126.30$**

End