Final Term Paper

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SECTION	A
SEMESTER	6th
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Question = 01

Part-a : Name the forces acting on dam. Explain any five of them in detail

:- NAME of forces Acting on Dam :

1) Water Pressure
2) Uplift Pressure
3) Wave Pressure
4) Silt Pressure
5) Ice Pressure
6) Self weight of the dam
7) Seismic force.

1) Water Pressure:- ~~the~~ water pressure is one of the mass major external forces acting on gravity dam. The horizontal water pressure exerted by the water stored on upstream side of dam can be collected from hydrostatic pressure distribution.

2) Uplift Pressure :-

Water seeping through the pores and fissures of the foundation material and water seeping through the dam of the body and there to the bottom through the joints b/w the body of the dam and its foundation at the base, exerts an uplift pressure on the base of the dam.

This kind of uplift pressure virtually reduces the downward weight of the body of the dam and hence acts against the dam stability. It is assumed that uplift pressure are not affected by the earthquake forces.

3) Silt pressure :-

If "h" is the height of silt deposited, then force exerted by the silt in addition to external water pressure can be represented by Rankine's formula.

$$P_{silt} = \frac{1}{2} \gamma_{sub} h^2 K_a \quad \& \text{ it act at } h/3 \text{ from base}$$

where

$$K_a = \frac{1 - \sin\phi}{1 + \sin\phi}$$

γ_{sub} = Submerged unit weight of silt material

h = height of silt deposited.

⇒ If the upstream face is inclined, the vertical weight of the sill which is supported on the slope will also acts as a vertical forces.
As per USBR, the total horizontal forces will be $1.8h^2$ Kn/m and vertical forces $4.6h^2$ kn/m.

4) Wave Pressure :-

Wave are generated on the surface of the reservioar by the blowing winds. which can cause a pressure toward the downstream side wave pressure and it depends upon the wave height. Wave height may be given by the following equation

$$h_w = 0.032\sqrt{V_f} + 0.763 - 0.271 f^{3/4} \quad (f < 32)$$

h_w = height of water from top of crest to bottom of through in meter.

V = wind velocity in Km/h

f = Fetch or Strenght of water in Km.

5) **Ice Pressure :-**

The ice which may be formed on the water surface of the reservior in cold countries may be sometimes melt and expand. The dam face then has to resists forces exerted by the expanding ice. This force acts linearly along the length of the dam and at the reservoir level. The magnitude of this force various from 250 – 1500 Kn/m²

6) **Question - 1**

Part-B Define the following terms

*) Liquidfication of soil
*) Buttress Dam
*) Infinite slop
*) Pier foundation
*) Dynamic load.

1) **Liquification of Soil :-** A Phenomenon where by a saturated or partially saturated soil substantially loses strength and stiffness in response to an applied stress, usually earthquake shaking or other sudden change in stress condition causing it to behave like liquid.

2) Buttress Dam :-

* A buttress dam or hollow dam is basically a derivation of a gravity dam with the introduction of intermediate space.
* With a buttress dam, the face of the dam is held by a series of supports or buttresses that are placed at intervals on the downstream side
* The buttresses work to combat the force of reservior water from trying to push the dam water.

3) Infinite Slop :-

An infinite slope is simply a vertical line. When you plot it on a line graph, an infinite slope is any line which runs parallel to y-axis. You can also describe this as any line that doesnot move along the x-axis but stays fixed at one constant x-axis coordinate, making the change along the x-axis 0.

4) Pier foundation :-

A pier foundation is a collection of large diameter cylindrical column to support the superstructure and transfer large superimposed load to the firm strata below. It stood several feet above the ground.

5) **Dynamic load :-**

Dynamic load vary in their magnitude, direction or position with the time.
The type of dynamic load on soil the foundation of a structure depend upon on the nature of the source producing it.

Question - 2 :- (Part - a)

Define shallow foundation. Explain type of shallow foundation in detail with appropriate sketch.

Shallow Foundation :-

★ **According To Terzaghi :-** The foundation in which depth of the foundation is less or equal to width of the foundation is called shallow foundation

$$D_f \leq B$$

★ **According To Bicemptan :-** The foundation in which D_f/B ratio is less than or equal to 2.5 than the foundation is called shallow foundation.

Type of Shallow Foundation:-

① **Wall / Strip footing:-** The footing which runs across the length of the wall and transfer the load of the wall to the soil safely It is called wall or strip footing

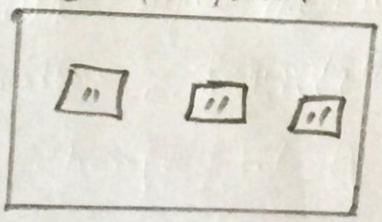
② **Combined footing:-**

The footing which is constructed for two or more column and transfer for the load of the two or more column to the soil safely then it is called combined footing

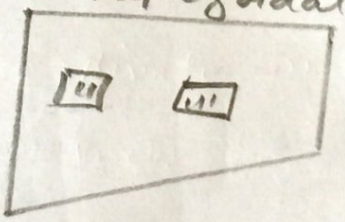
☆) If the load of column is uniform then the combined footing will be rectangular in shape

☆) If the load of the column is not uniform then shape of combine footing will trapezoidal.

Rectangular



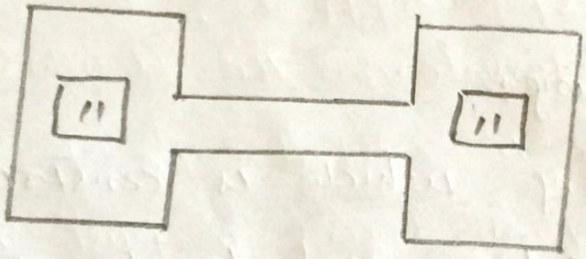
Trapezoidal.



③ **Raft or MAT footing:** The footing which covers the whole area of the structure is called raft footing. This type of footing is proposed in area which have soil weak in bearing capacity.

4) **Strapped footing :-**

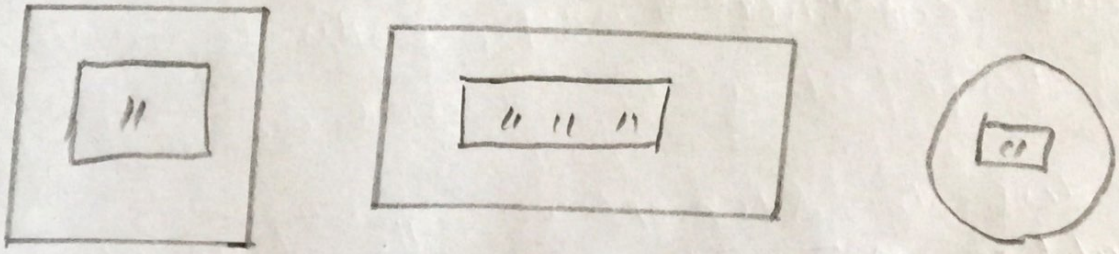
The footing in which the outer column is connected with the inner column by mean of the beam or strap is called strapped footing.



(5) **Column Footing :-**

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

It may be circular, square and rectangular in shape.



Question-2 Part-b

Why ground improvement technique are important Explain five methods of ground improvement in detail along with appropriate sketch.

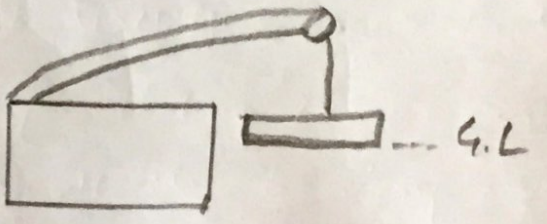
Ground improvement Technique are important :-

The improvement of ground technique are important because of the soil in which volumetric changes take place due to shrinkage and swelling such soil needs ground important Techniques.

*) The soil which is organic in nature
*) The soft soil also required ground improvement Techniques
*) The soil which is sandy and gravely.

Five Methods of Ground Improvement Technique :-

1) Dynamic Compaction :- This method is used to increase the bearing capacity of soil. This also increase the consolidation of rate. This method also increase the density of soil. In this method actually densification of soil take place.



② Vibro Compaction:-

*) It is also called Vibro densification.

*) In this method the compaction takes place at a certain depth in granular soil through vibratory probe.

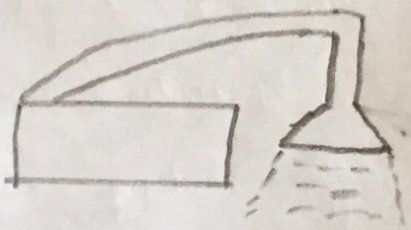
*) This vibratory probe is run by an electric motor. The penetration of probe is enhance by ejecting water at the tip of probe.

③ 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.

⇒ This impact energy is actually applied through hydraulic ramp.

⇒ This hydraulic ramp weight varies from 4–8 tons.



④ **Wet Soil Mixing :**

In this method of ground improvement Technique a paste of cement is prepared and inserted in the soil. This method is used to improve the characteristics of weak soil by using cementitious binder slurry.

⑤ **Dry Mixing of Soil :**

Dry Soil Mixing is ground improvement Technique by which the chdocteristics of weak soil are improved by using dry cementitious binder.

Question = 03

GIVEN DATA :-

$C = 25\ KN/m^2$

$\phi = 16^\circ$

$G = 2.72$

$e = 0.50$

Required :-

* F_c (FOS) when soil is dry
* F_c (FOS) when there is seepage in soil

Solution :-

As we know that

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

$$\therefore \quad \gamma_d = \frac{G_s \times \gamma_w}{1+e} = \frac{2.79 \times 9.8}{1+0.5}$$

$$\boxed{\gamma_d = 17.8 \text{ KN/m}^2}$$

Then

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

$$\boxed{F_c = 1.18}$$

When there is seepage of water

Then

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

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

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

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

$$\boxed{\gamma = 21.04\ kN/m^3}$$

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

$$\gamma' = 21.04 - 9.8$$

$$\boxed{\gamma' = 11.24\ kN/m^3}$$

Then

$$Fc = \frac{25}{21.04 \times 6 (\sin 28^\circ)(\cos 28^\circ)} + \frac{11.24}{21.04} \times \frac{\tan 16^\circ}{\tan 28^\circ}$$

$$\boxed{Fc = 0.816}$$

Question - 4

Given Data

- ★ Height = H = 10 m
- ★ C = 18.8 KN/m^2
- ★ γ = 17 KN/m^3
- ★ ϕ = 30°
- ★ FOS = 1.5
- ★ F_ϕ = 1.0

Required :- Inclination i = ?

Solution :- As we know that

$$S_N = \frac{C}{FOS \times \gamma \times H}$$

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

$$S_N = 0.073$$

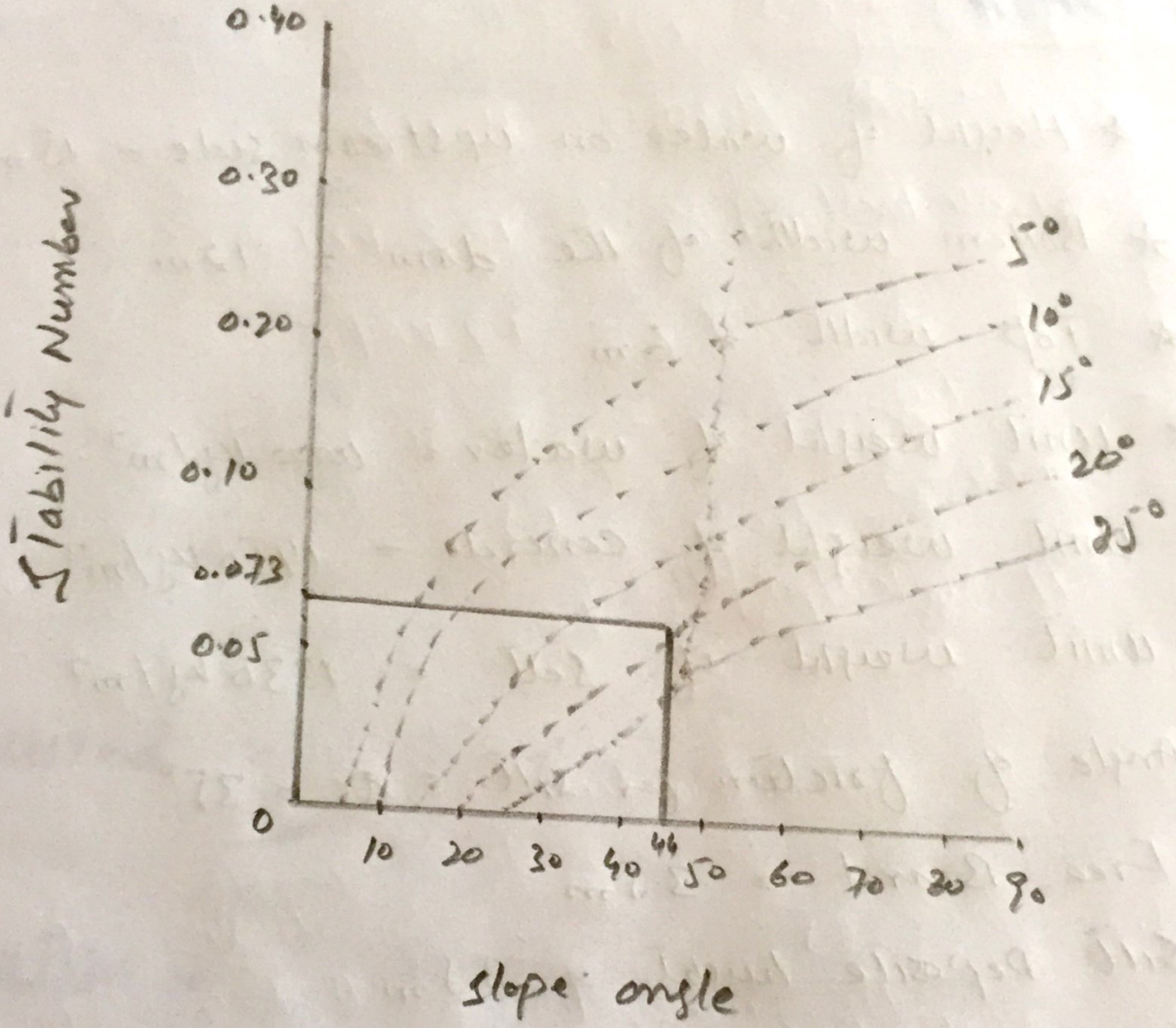
Using Taylor chart for

ϕ = 30°

S_N = 0.073

then

i = 44 (From Taylor chart)


Stability Number
0·40
0·30
0·20
0·10
0·073
0·05
0
5°
10°
15°
20°
25°
10
20
30
40
46
50
60
70
80
90
Slope angle

Question - 4

Part - b

GIVEN DATA

* Height of water on upstream side = 15m
* Bottom width of the dam = 12m
* Top width = 6m
* unit weight of water = 1000 kg/m³
* unit weight of concrete = 1450 kg/m³
* unit weight of Sell = 1330 kg/m³
* Angle of friction for silt = $\phi_s = 35°$
* Free Board = 3.5m
* Silt Deposite height = 2.5m

Required :- Silt pressure = ?

Solution :-

As we know that

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

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

$$\boxed{P_s = 1126.30 \text{ kg/m}}$$