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Subject :- Hydraulic Structure

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2 CR. HRS

Section :- A

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Qno1

(a) Define vesevvoiv also explain which type of vesevvoiv will be move economical and why?

Ans :- A vesevvoiv is a man-made lake or large freshwater body of water. Many people think of a vesevvoiv as a lake and might even use the word interchangeably However, the key difference is that vesevvoivs ave avtificial and made by humans, while lakes ave naturally occuving bodies of water. Vesevvoivs ave great because they pvovide a supply of water for when natuvaly occuving bodies of water like lakes ov vivevs vun dvy.

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Mainly three types of reservoirs

① Valley domed reservior

② Bank-side reservior

③ Service reservior

In all the above three types of reservoirs, Service reservoir is one of the most economical type of reservior. It is entively man made It require small amount of area as compared to others. Its frame is easily constructed and built. And it does not need any natural water body diversion.

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Qno 1.

(b) Which type of embankment dam you will suggest in hilly areas and why?

Ans

There are three types of embankment Earth fill Embankment, Rock fill embankment Earthfill embankment are the one which consist of 50% or more soil while the otheve rock fill embankment are the the one which consist of 50% or more rock. If we are asked to build an embankment dam in a hilly area, we should go with the option of rockfill embankment because it has more strength than compared to Earth-fill embankment and the other reason is that in hilly areas rock availibility is easy and which is going to make our project more economical and save

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Qno2

(a) List down different type of spillway also mention which type of spillway will be more efficient in condition where freezing point of water is less than -10 degree centigrate in winters and why

Ans Spillways :- A spillway is a channel or passageway through which flood/ surplus water escapes or release safely from a reservoir or dam. They are provided for all dams as a safty measure against overtopping and the consequent damages and failure. It acts as a safty valve for the dam

=> Different types of spillway are as follow

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① Straight Drop Spillway :-

A straight drop spillway consists of low height weir wall having its downstream face roughly or perfectly vertical. When the water level in the reservoir rises above the normal pool level, the surplus water falls freely from the crest of the wier and hence it is known as straight drop spillway or free overfall spillway

② Ogee-Shapped Spillway :-

It is the most commonly used spillway. It is widely used with gravity dams, arch dams & buttress dams. Several Earth & Rockfill dams are also provided with this type of spillway as a superstructure. An Ogee-shaped spillway has a control wier of ogee-shaped

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which is like elongated english letter 'S'. The upper part of the spillway surface matches closely to the lower nappe of a ventilated sheet of water falling freely from a sharp-crested wier. Downstream & Upstream profile of ogge spillway

③ Shaft Spillway :-

A Shaft spillway consist of a horizontal crest & vertical shaft with its top surface at the crest level of the spillway and its lower end connected to a vertical shaft The other end of the vertical shaft is connected to a horizontal conduit or tunnel, which extends through or around the dam and carries the water to the river downstream. A shaft spillway is used at the sites where the conditions are not favorable for an overflow or a chute spillway

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④ Chute Spillway :-

It is a type of spillway in which surplus water from upstream is disposed to the downstream through a steeply sloped open channel. It is generally constructed at one end of the dam or separately away from the dam in a natural saddle in a bank of the river.

⑤ Side Channel Spillway :-

Side channel spillway is similar to chute spillway but the only difference is the crest of side channel spillway is located on one of its sides whereas crest of chute spillway is located between the side walls. In other words, the water spilling from the crest is turned to 90 degrees and flows parallel to the crest

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of side channel spillway unlike in chute spillway

⑥ Siphon Spillway :-

A siphon spillway is a type of spillway in which surplus water is disposed to downstream through an inverted U shaped Conduit. It is generally arranged inside the body or over the crest of the dam.

⑦ Labyrinth Spillway :-

A labyrinth spillway is a type of spillway in which the weir wall is constructed in a zigzag manner in order to increase the effective length of the weir crest with respect to the channel width. This increase in effective length raises the discharge capacity of the weir

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and hence higher water flow at small heads can be conveyed to the downstream easily.

=> The type of spillway which will be more efficient in condition where freezing point of water is less than -10°c is Ogge-Shapped spillway It is the most commonly used, widly used with gravity dams, arch & buttress dams.

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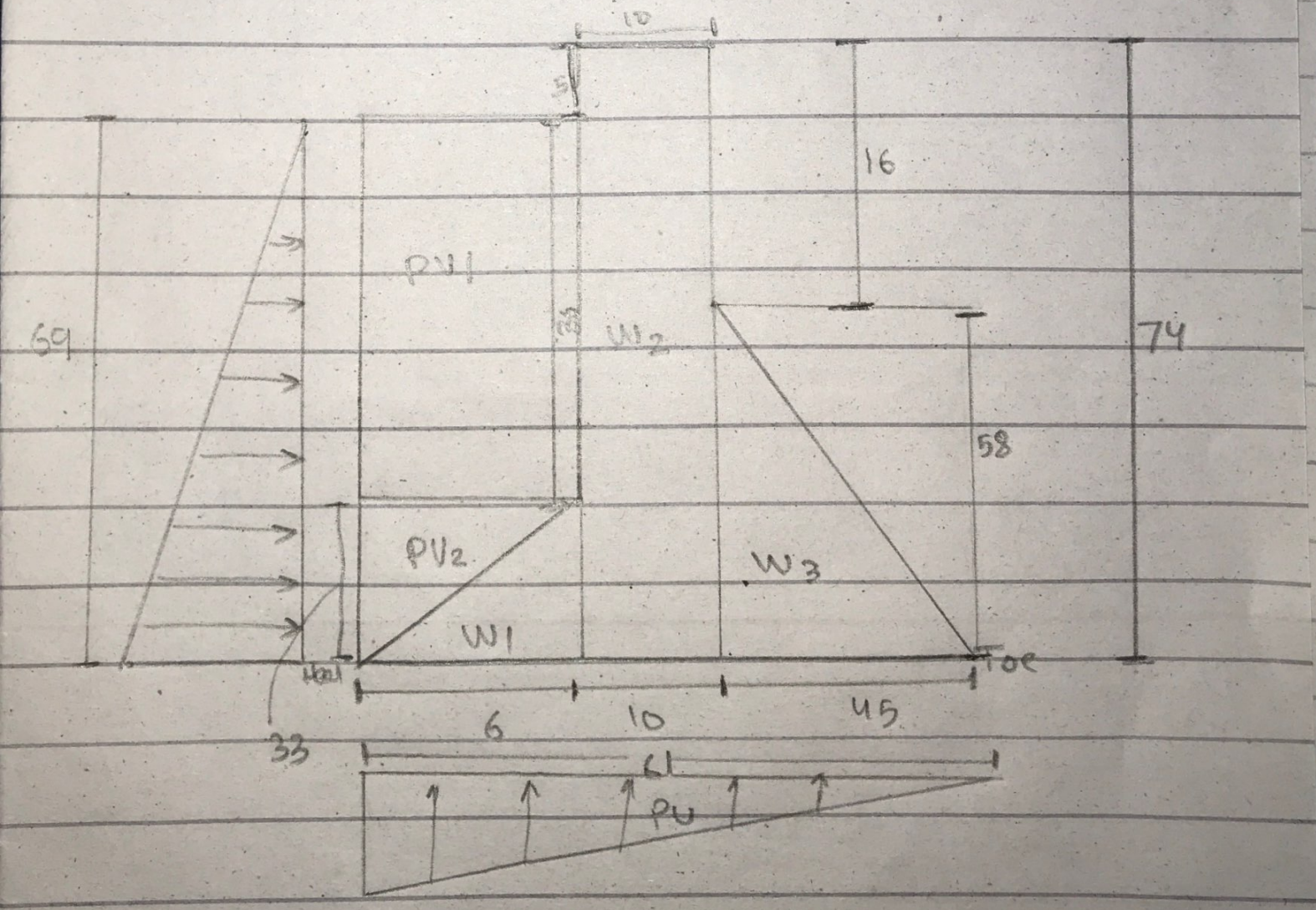
Q no 3

(a) Design the gravity dam by assuming the dam dimensions. Find all stability checks at least 3 of them must be in safe condition and economical. In reservior full condition considering weight of dam, water pressure and up lift pressure.



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Assume unit weight for concrete = 24 KN/m³

Assume unit weight for water = 10 KN/m³

Forces	Forces calculation	Fv	FH	Lever Arm	M_r	M_o
W_1	(1/2) x L x W x γd	2376	0	57.00	135432.	0
W_2	L x W x γd	17760	0	50.00	888000	0
W_3	(1/2) x L x W x γd	31320	0	30.00	939600	0
P_{U1}	(1/2) x L x W x γw	990	0	59.00	58410	0
P_{U2}	L x W x γw	2160	0	58.00	58410	0
P_U	(-(1/2) x L x ½ x γw	-21045	0	40.67	0	855830
P_H	(-(1/2) x L x W x γw)	0	-23805	23.00	0	547535
	Σ	33561	-23805		2146722	1403365

for factor of safty against tension

Condition

$e < B/6$

$B/6 = 10.17m$

eccentricity of resultant force

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$e = (B/2) - \bar{x}$

$\bar{x}$ = Location of Resultant force from Toe

$\bar{x} = (\Sigma M_v - \Sigma M_o) / \Sigma f_v$

for factor of safty against stress

Condition → $Y_{heel} > 0$

$Y_{Toe} = (\Sigma f_v / B)(1 \pm (6e/B))$

$Y_{Toe} = 1002.0484 \text{ kN/m}^3$

$Y_{heel} = (\Sigma f_v / B)(1 - (6e/B))$

$\boxed{Y_{heel} = 98.31 \text{ kN/m}^3}$

Condition → Safe in stress (ok)

⇒ for factor of safty Against overturning

Condition → $(\Sigma M_v / \Sigma M_o) > 2$

$= (\Sigma M_v / \Sigma M_o) = 1.63$

Condition → Not safe in overturning (Not ok)

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$(\Sigma M_V > \Sigma M_O)$

$\Sigma M_V = 2146722.0$

$\Sigma M_O = 1403345$

Condition → Safe (ok)

For factor of safty against sliding

Condition → $((\mu \Sigma f_V + B_q)/\Sigma F_H) > 1$

$q = 1400$

$\mu = 0.7$ (0.65 to 0.75)

$((\mu \Sigma F_V + B_q)/\Sigma F_H) = 4.57$

Condition → Safe in sliding (ok)

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