HYDRAULIC STRUCTURE

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Q No. 1

Part A :-

Answer :-

Reserviour :

A reservior is a man-made lake or large fresh water body of body. Many people think of a reservior as a lake and might even use the words interchangeably. However, the key difference is that reserviors are artifical and made by humans, while lakes are naturally occuring bodies of water. Reserviors helps us when the natural occuring bodies of water i.e lakes, rivers etc gets dry.

There are three types of Reservior.

valley dammed reservior.
Bank side reservior.
Service reservior.

Service Reservior:-

The most economic type of reservior. Because the service reservior requires less time to construct comparatively to the other two types of reservior, which will save us labor costs and other material such as, machinery rent and other things which helps us to construct a reservior. and bank side reservior, it will cause less material other than valley dammed reservior and bank side reservior, which will also help in reduce our costs in the construction of reservior.

It also requires less area to construct which will further reduce our cost.

Q 1

(b)

There are two types of embankmals dams. Earth fill embankments and Rock fill embankments. Earth fill embankments are the one which consists of 50% or more soil. While Rock fill embankments are the one which consists of 50% or more rocks. If we have to build an embankment in a hilly area, we should build Rock fill embankments because it consists of rocks and in hilly area rocks are easily availble, however rock fill embankments have more strength other then earth fill embankments. So we if we build a rock fill embankments in a hilly area it will have more strength and

with less cost.

Q2:-

Different types of spillways

1:- Straight Drop Spillways
2:- Ogee Spillways
3:- Shaft Spillways
4:- Chute Spillways
5:- Side channel
6:- Siphon spillways
7:- Labyrinth Spillways

A shaft spillway or bell mouth spillway should be used in area having temperture -10°C or below. As this spillway is designed like an inverted bell where water can entre around the entire parameter. These uncontrolled spillway are also morning glory or glory hole spillway.

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In the areas where the surface of the reservior may freeze. This type of spillway is normally filled with ice breaking arrangment to pervent the spillway from becoming ice-bound.

Q3:-

sol:-

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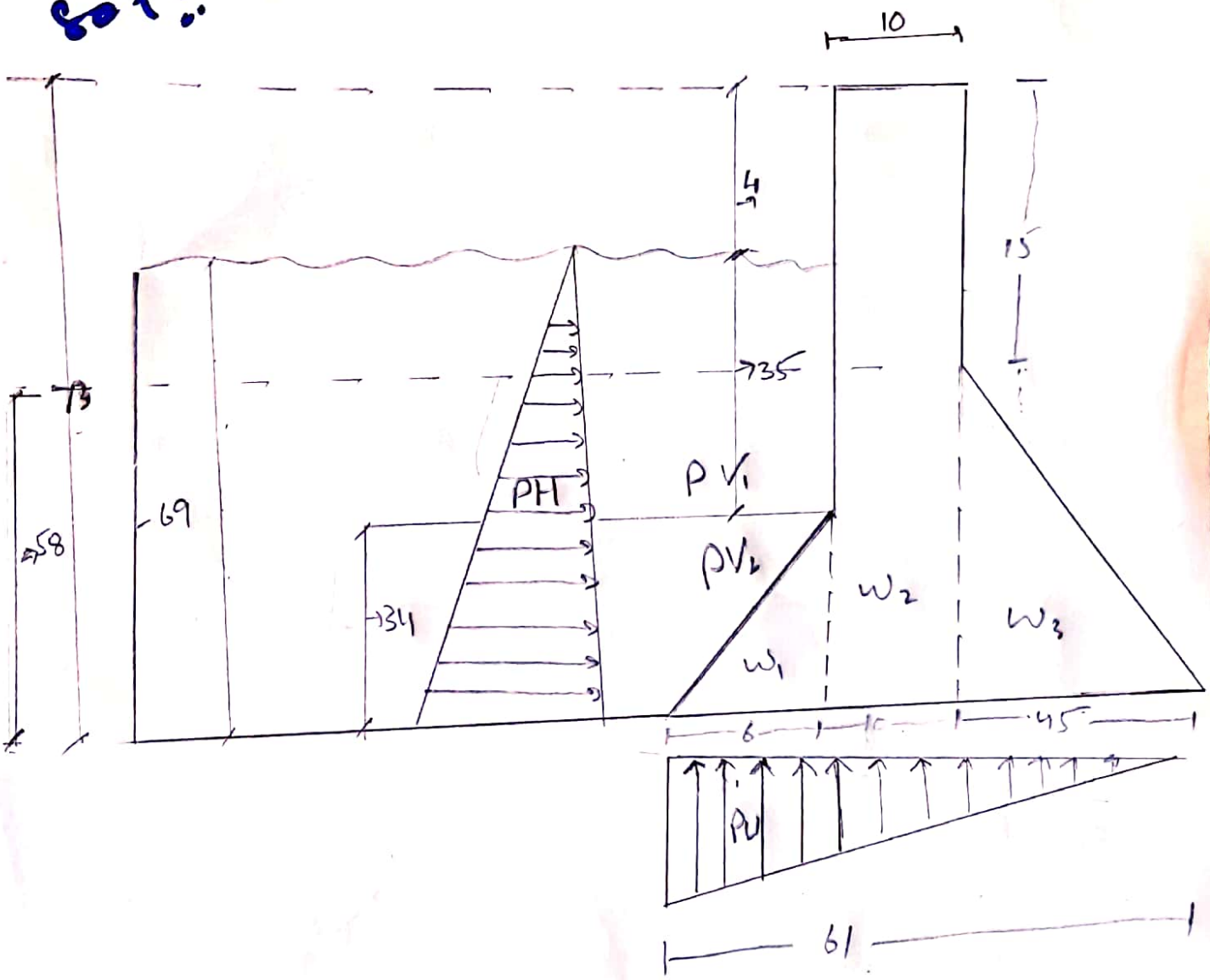

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Assume Unit Weight for Concrete = 24 KN/m³

Assume Unit Weight For Water = 10 KN/m³

Forced and moment Calculations

Forces	Forced Formula	F_v (KN)	F_H (KN)	Lever Arm (m)	M_r	M_o
W_1	$(1/2)\times L\times W\times \gamma_d$	2448	0	57.00	139536.00	0
W_2	$L\times W\times \gamma_d$	17520	0	50.00	876000.0	0
W_3	$(1/2)\times L\times W\times \gamma_d$	31320	0	30.00	939600.0	0
P_{V_1}	$(1/2)\times L\times W\times \gamma_w$	1020	0	59.00	60180	0
P_{V_2}	$L\times W\times \gamma_w$	2100	0	58.00	121800.00	0
P_O	$(-(1/2)\times L\times W\times \gamma_w)$	-21045	0	40.67	0	855830
P_H	$(-(1/2)\times L\times W\times \gamma_w)$	0	-23805	23.00	0	547515
	Σ	33363	-23805	Σ	2137116.0	1403345

For Factor of Safety Against Tension

Condition = $e < B/6 \rightarrow B/6 = 61/6 = 10.17$ m

Eccentricity of the Resultant Force

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

$\dot{x}$ = Location of Resultant Force from Toe

$\dot{x} = (\Sigma M_r - \Sigma M_o)/\Sigma F_v$

$$\dot{x} = \frac{2137116 - 1403345}{33363}$$

$\dot{x} = 21.99$

So $e = 8.51$ m

For factor of Safety Against Stress

Condition → $\gamma_{heel} > 0$

$\gamma = (\Sigma Fv/B)(1 \pm (6e/B))$

$\gamma_{toe} = (\Sigma Fv/B)(1 + (6e/B))$

$= \left(\frac{33363}{61}\right)\left(1 + \left(\frac{6 \times 8.51}{61}\right)\right)$

$\gamma_{toe} = 1004.5542$ kN/m³

$\gamma_{heel} = (\Sigma Fv/B)(1 - (6e/B))$

$\gamma_{heel} = \left(\frac{33363}{61}\left(1 - \frac{6 \times 8.51}{61}\right)\right)$

$\gamma_{heel} = 89.31$ kN/m³

Condition → Safe in Stress

For factor of Safety Against Overturning

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

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

$\left(\frac{2137116}{1403345}\right) = 1.52$

Condition → Not Safe in overturning (Not OK)

$(\Sigma M_r > \Sigma M_o)$

$(\Sigma M_v > \Sigma M_o)$

$\Sigma M_v = 2137116.0$

$\Sigma M_o = 1403345$

Condition → Safe (OK)

For Factor of safety Against Sliding

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

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$q = 1400$

$\mu = 0.7$

$(0.65 + 0.75)$

$((\mu \Sigma FV + Bq) / \Sigma FH)$

$\left((0.7 \times 33363 + (61 \times 1400)) / 23805\right) = 4.57$

Condition in safe in Sliding (OK)