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Subject Hydraulic Structures

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Q1 (a) Define reservoir also explain which type of reservoir will be more economical and why?

Ans Reservoir:-

A reservoir is a man-made lake or large freshwater body of water. Many People think of reservoir as a lake and might even use the word interchangeable. However, the key difference is that reservoirs are artificial and made by humans, while lakes are naturally occuring bodies of water. You can store water in a reservoir and then it can be used when naturally occuring bodies of water runs dry.

Types:-

1) Valley dammed Reservoir
2) Bank-Side Reservoir
3) Service Reservoirs.

Most economical:-

Service reservoir is the most economical reservoir because it is completely man-made. It does not need any natural water body diversion and its frame is easily constructed. Very small space is required for its construction.

b) which type of embankment dam will you suggest in a hilly area?

Ans:- Rock-fill embankment is suggested in a hilly area because it consists of 50% of rocks as a fill material In hilly areas rocks are easily available which makes it more economial. It also provides more strength due to rocks as a filler. Can also be easily constructed in hilly areas.

Q2 (a) List down different types of spillways also mention which type will be more efficient where the freezing point of water is less than -10°C in winters:-

Ans Types of Spillways:-

1) Straight Drop Spillways
2) Ogee Spillway
3) Shaft Spillway
4) Chute spillway
5) Side channel Spillway
6) Siphon Spillway
7) Labyrinth Spillway.

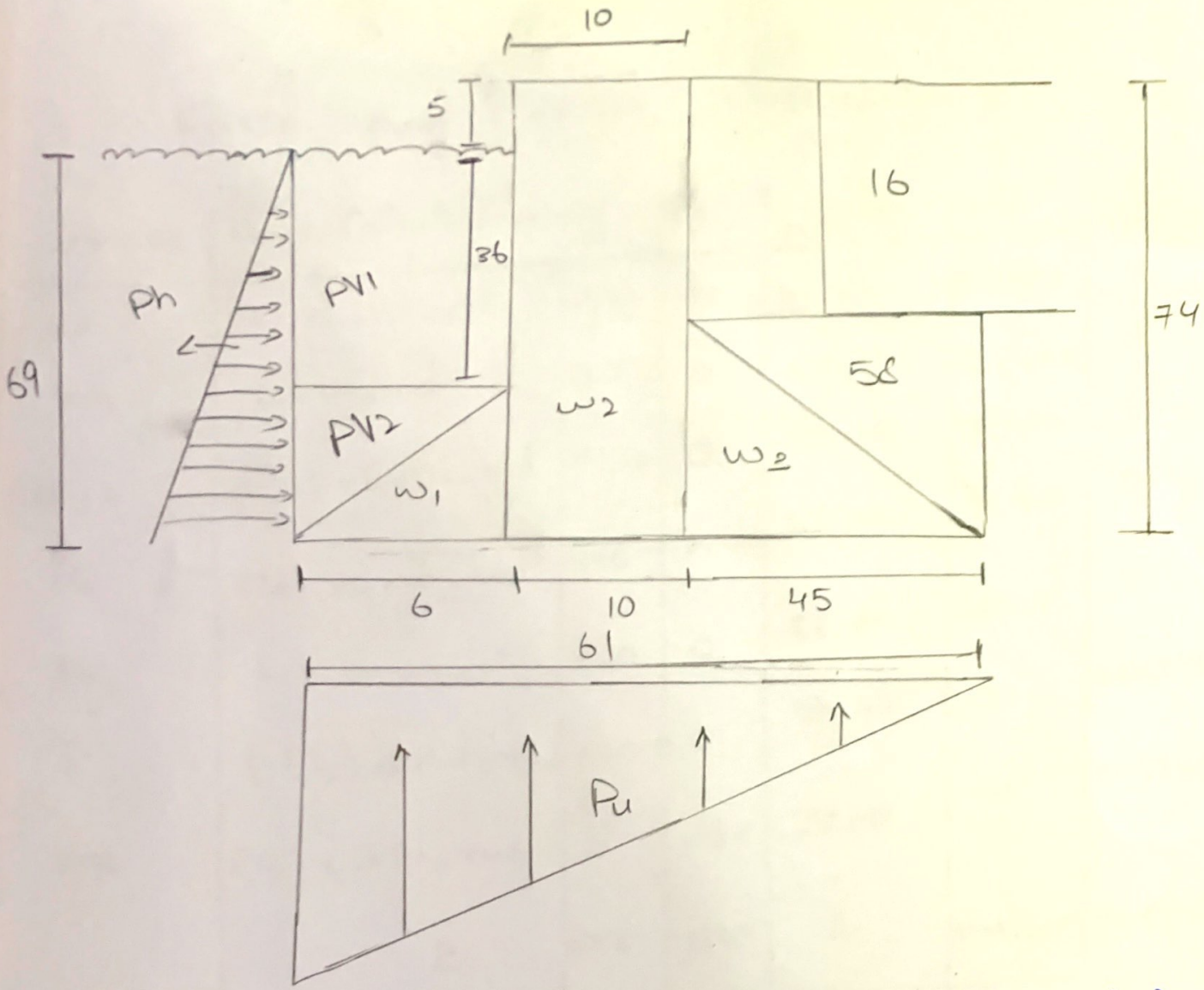
Ogee Shaped Spillway:-

The type of spillway which will be more efficient in a condition whose freezing point is less than -10°C is ogee shaped spillway.

An ogee shaped spillway looks like an english letter "S". It is the most commonly used spillway. It is widely used with gravity dams, arch dams & buttress dams. Several Earth and Rock fill dams are also provided with this type of spillway as a super structure.

Q3 (a)

Design the gravity dam by assuming the dam dimensions. Find all the stability checks at least three of them must be in a safe condition & economical for reservoir full condition considering weight of dam, water pressure and uplift pressure.



Assume unit weight for concrete = 24kN/m³

Assume unit weight for water = 10kN/m³

Force and Moment Calculations

Forces	Force Calculations	Fy	Fx	Lever (m) arm	Mx	Mo
W_1	$(1/2) \times L \times W \times \gamma d$	2376	0	57.00	135432	0
W_2	$L \times W \times \gamma d$	17760	0	50.00	888000	0
W_3	$(1/2) \times L \times W \times \gamma d$	31320	0	30.00	939600	0
P_{V_1}	$(1/2) \times L \times W \times \gamma w$	990	0	59.00	58410	0
P_{V_2}	$L \times W \times \gamma w$	2160	0	58.00	58410	855830
P_4	$(-(1/2) \times L \times W \times \gamma w$	-2104	0	40.67	0	547535
PH	$(-1/3) \times L \times W \times \gamma w$	0	-23805	23.00	0	
	Σ	33561	-23805	Σ	2146722.9	1403345

Now,

For Factor of Safety Against Tension:-

Condition

$e < B/6$

$\frac{B}{6} = 10.17m$

eccentricity of the resultant force

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

$\bar{x}$ = location of Resultant from Toe

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

$\bar{x} = 22.15$

So $e = 8.35m$

Condition → Safe in Tension (Ok)

For Factor of Safety Against Stress:-

Condition → $\gamma_{heel} > 0$

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

$$\gamma_{Toe} = 1002.0484\ KN/m^3$$

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

$$\gamma_{heel} = 98.31\ KN/m^3$$

→ Condition Safe in Stress (Ok)

For Factor of Safety Against Overturning

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

$= (\Sigma M_r / \Sigma M_o) = 1.53$

Condition → Not Safe in overturning (Not Ok)

[redacted]

$(\Sigma M_r > \Sigma M_o)$

$\Sigma M_r = 2146722.0$

$\Sigma M_o = 1403345$

Condition → Safe (Ok)

For Factor of safety Against Sliding :-

Condition → $((\mu \Sigma fv + Bq)/\Sigma FH) > 1$

$q = 1400$

$\mu = 0.7$ (0.65 to 0.75)

$((\mu \Sigma fv + Bq)/\Sigma FH) = 4.57$

Condition → Safe in Sliding (OK)