HYDRAULIC STRUCTURE

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Section : A

Submitted to:

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Q No 01 => Answer (Part A)

Reservoir

A reservoir is a manmade lake or large fresh water body of water. Many People think of a reservoir as a lake and might even use the words interchangeable. However, the key difference is that reservoirs are artifical and made by humans, while lakes are naturally occuring bodies of water.

Reservoir are great because they provide water in case when naturrally occuring bodies of water i.e lakes, river etc get dry.

→ There are mainly three types of Reservoir

- Valley dammed reservoir
- Bank-side reservoir
- Service reservoir

In the above three types service reservoir is the most ecnomic reservoir As the service reservoir are time efficient to ~~construct~~ construct compared to the other reservoir. which will be ecnomical in terms of labour cost, machinery rent and other required stuff. Further more it will required less material then the valley cameel reservoir and bank side reservoir Additionaly it can be built on small area which can further reduce the cost.

Q No: 01 (b)

There are basically two types of Embackment

⇒ Earth fill Embackment

⇒ Rock fill Embackment

The Embackment which we suggested in hilly areas is "Rock fill Embackment" because it is one which contains about 50% or more rock fill materials of the total volume of materials; thus can be easily Provided in hilly areas and will be economical.

Similarly it is constructed on hard rock type foundation which can be easily provided in hilly areas. as well as rock form's best foundation material which are free from faults, seams of soft shale or clay etc.

Additionally shoulders of rock fill also provided structural stability.

Q.No (02)

Types of Spillways

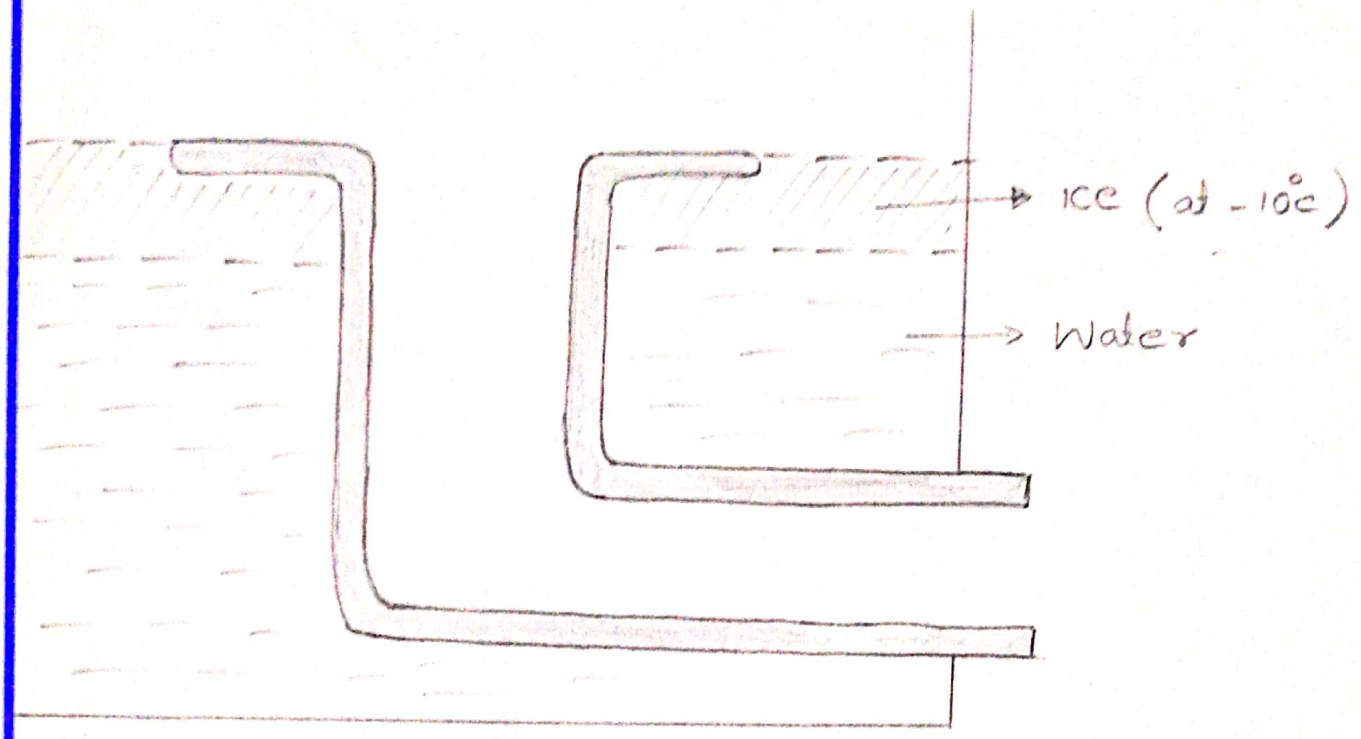
There are different types of spillways which are as following;

→ Straight Drop Spillway
→ Ogee Spillway
→ Shaft Spillway
→ Chute Spillway
→ Side channel Spillway
→ Siphon Spillway
→ Labyrinth Spillway

shaft spillway is the best approch then the conventional approach for water discharge from the reservoir towards down stream in case of overflow situation i.e flood situation. Normally when temperature reaches to -10c the top layer of water is converted into ice which make hardles for the water discharge. As it causes the blockage of conventional gates and spillways. where as shaft spillway are advantageous In above condition as they are constructed in such away that no water stay at the top opening as shown in figure 1. As flood occurs it rises the water level in reservoirs. and in such condition when the top of surface of water get freezes

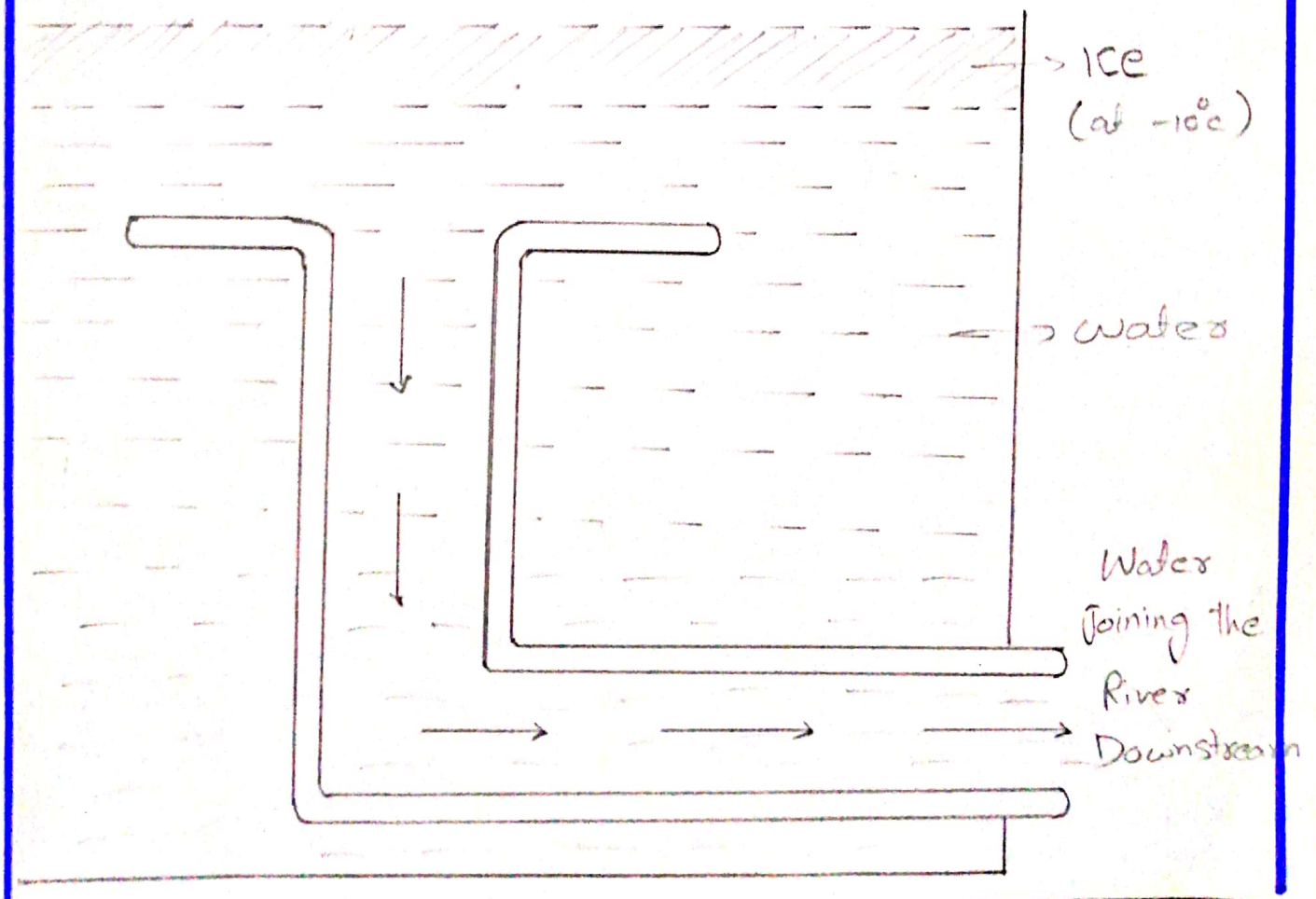
The shaft spillway is very ffelpfull in water discharging towards down stream in figure 2.

To Sumup, shaft spillway is better approch for water discharge from the reservair in freezing as well as in flood condition.



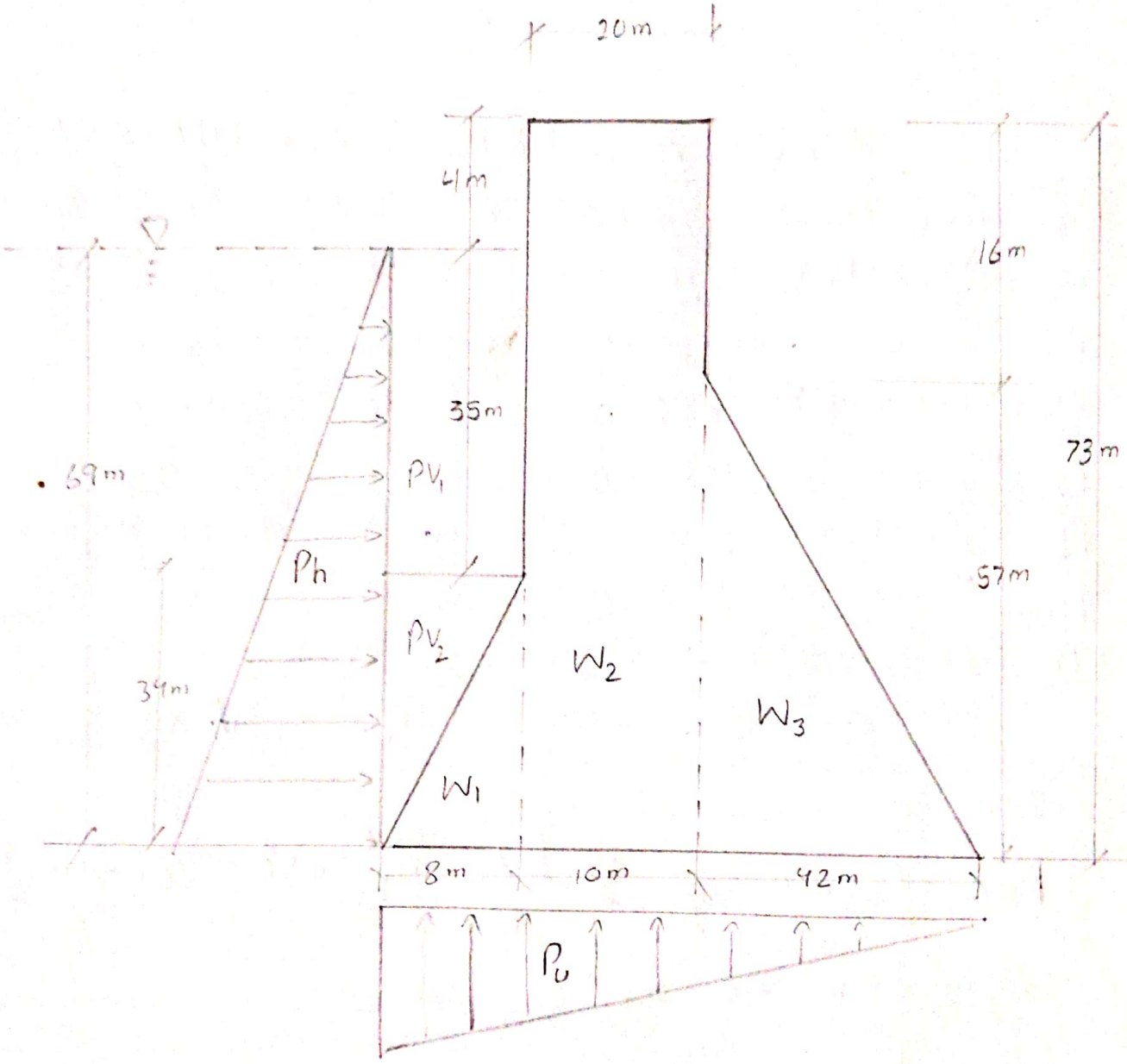
Shaft Spillway (Normal Condition) Figure 1

Shaft Spillway (Flood Condition) Figure 2



QNO: 3

Solution:



Assume:-

Unit weight of concrete = 24 KN/m³

Unit weight of water = 10 KN/m³

Forces	Forces Formulas	F_v(KN)	F_H(KN)	Lever Arm (m)	M_r	M_o
W_1	$(1/2)\times L\times W\times \gamma_d$	3264	0	54.67	178432.00	0
W_2	$L\times W\times \gamma_d$	17520	0	47.00	823440.0	0
W_3	$(1/2)\times L\times W\times \gamma_d$	28728	0	28.00	804384.0	0
PV_1	$(1/2)\times L\times W\times \gamma_w$	1360	0	57.33	77973.33	0
PV_2	$L\times W\times \gamma_w$	2800	0	56.00	156800.00	0
PU	$(-(1/2)\times L\times W\times \gamma_w)$	-20700	0	40.00	0	828000
Ph	$(-(1/2)\times L\times W\times \gamma_w)$	0	-23805	23.00	0	547515
	Σ	32972	-23805	Σ	2010293	1375515

For Factor of Safety Against Tension

Condition → $e < B/6$

$B/6 = \frac{60}{6} = 10.00\,m$

Eccentricity of the Resultant Force

$e = (B/2) - \bar{x}$ — (1)

$\bar{X}$ = Location of Resultant Force from Toe

$$\bar{X} = \frac{(\Sigma M_r - \Sigma M_o)}{\Sigma F_v} = \frac{(2041029.3 - 1375575)}{32972}$$

$$\bar{X} = 20.18$$

eq1) $\Rightarrow$ So $e = 9.82$ m

Condition $\rightarrow$ Safe in Tension

$\rightarrow$ For Factor of safety Against Stres

Condition $\gamma_{heel} > 0$

$$\gamma = (\Sigma F_v/B)(1 \pm (6e/B)) = (32972/60)\left(1 \pm \left(\frac{6 \times 9.82}{60}\right)\right)$$

$$\gamma_{Toe} = (\Sigma F_v/B)(1 + (6e/B))$$

$$\gamma_{Toe} = (32972/60)(1 + (6 \times 9.82/60))$$

$$\gamma_{Toe} = 1088.94 \text{ KN/m}^3$$

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

$$\gamma_{heel} = (32972/60)(1 - (6 \times 9.8/60))$$

$$\gamma_{heel} = 10.12 \text{ KN/m}^3$$ Safe in Stress

→ For Factor of Safety Against overturning

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

$= (\Sigma M_r / \Sigma M_o) = (2041029.3 / 1375515)$

$\Sigma M_r / \Sigma M_o = 1.48$

Not safe in Overturning

→ $\Sigma M_r > \Sigma M_o$

$\Sigma M_r = 2041029.3$

$\Sigma M_o = 1375515$

condition Safe (OK)

→ For Factor of Safety Against Sliding

Condition → $(4\Sigma F_v + BqV) / \Sigma F_H) > 2$

$qV = 1400$

$4 = 0.7$ (0.65 to 0.75)

$$(4\Sigma F_V + B_{qV}) / \Sigma F_H) = ((4 \times 32972) + (60 \times 1400) / 23805$$

$$(4\Sigma F_V + B_{qV}) / \Sigma F_H) = 4.50$$

Condition → Safe in sliding (OK)