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Section	B
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QNO 1

(9) Reservoir:- A Reservoir is man-made lake or large fresh water body of water.

Many People Think of a reservoir as a lake and might even use the words interchangeably

However, the key difference is that reservoirs are artificial and made by humans while lakes are naturally occurring bodies of water.

Reservoirs are great because they provide a supply of water for when naturally occurring bodies of water, like lakes or rivers, run dry.

Mainly Three Types of reservoir

- Valley dammed reservoir.
- Bank Side reservoir
- Service reservoir

In above three reservoir Service reservoir is most economical because there no hydraulic equipment is used and man made structure. His structure is easily constructed. No heavy machinery is used & simple used of concrete that's why more economical.

Q1
(b)

Types of Embankment dam

- Earthfill Embankment dam
- Rockfill Embankment dam.

Rockfill Embankment dam are those which consist 50% or more rock while Earth^{fill} Embankment dam or those which consist 50% or more soil so

we have to build an embankment dam in hilly area we have built rockfill embankment because

rockfill have more suitable & strengthfull than Earthfill embankment and in hilly area rocks will easily available.

Q2

TYPES OF SPILLWAYS:

- (1) Straight Drop Spill way.
- (2) ogee Spillway
- (3) Shaft Spillway
- (4) Chute Spillway.
- (5) Side channel spillways.
- (6) Siphon Spillways.
- (7) labyrinth Spillways.

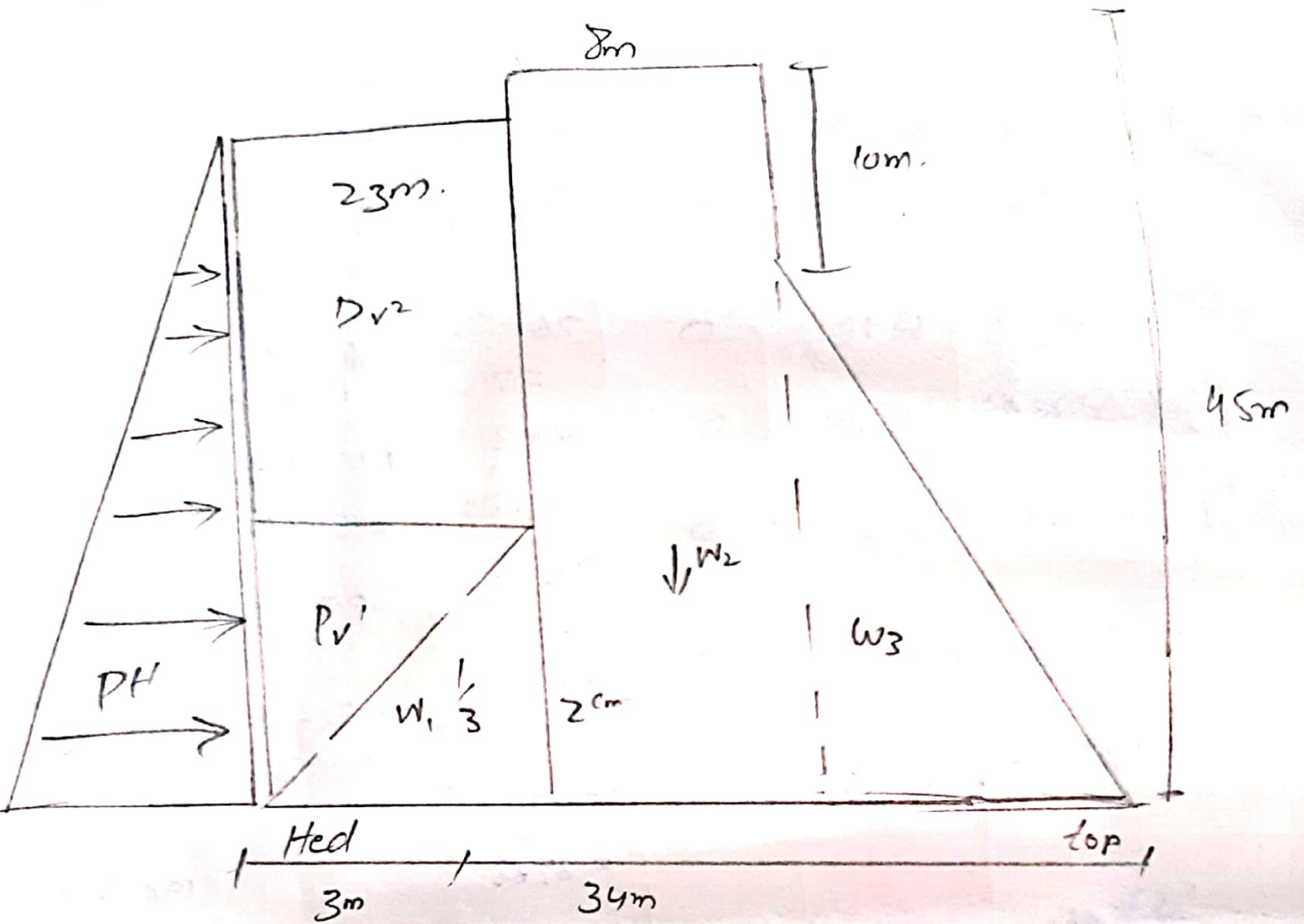
Chute Spillways \Rightarrow chute spillways

is the types of spillways in which the surplus water from upstream is disposed to the downstream through a steeply sloped open channel.

\rightarrow So this types of spillways will be more efficient in a condition where freezing point of water is less than 10 degree Centigrade in winter.

\rightarrow i.e. The water converted to ice form started so the chute spillway have steep slope and easily ice come to down stream and dam is safe from failure due to extra load of ice.

Q3



Force	Force cal	Fv (kN)	FH	Lever Arm	M _v	M _o
W ₁	$\frac{1}{3} \times 3 \times 20 \times 24$	720	0	$43 \times \frac{1}{3}$ = 35	720×35 = 25200	
W ₂	$8 \times 45 \times 24$	8640	0	$26 + \frac{8}{2}$ = 30	8640×30 = 259200	
W ₃	$\frac{1}{2} \times 35 \times 26 \times 24$	10920	0	$26 \times \frac{2}{3}$ = 17.33	17.33×10920 = 1892436	
P _{v1}	$\frac{1}{2} \times 20 \times 3 \times 10$	300	0	$34 + 3 \times \frac{2}{3}$ = 38	300×38 = 11400	
P _{v2}	$23 \times 3 \times 10$	690	0	$34 + \frac{3}{2}$ = 35.5	35.5×690 = 24495	
P _H	$-\frac{1}{2} \times 37 \times 43 \times 10$	-7955	0	$37 \times \frac{2}{3}$ = 24.66		196170.3
P _H	$-\frac{432}{2} \times 10$		9245	$\frac{43}{3} = 14.3$		132203.5

$$\sum F_v$$

$$13315$$

$$\sum F_v$$

$$= 9245$$

$$\sum F_r = \sum M_o$$

$$508938.6$$

$$\sum M_o$$

$$328313.8$$

eccentricity of resultant force

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

\bar{x} = location of resultant force

~~from toe~~

From toe

$$\Rightarrow$$
$$x = \frac{\sum M_y - \sum M_o}{\sum F_v}$$

$$= \frac{508938.6 - 328373.8}{13315}$$

$$= \frac{180564.8}{13315}$$

$$x = 13.56$$

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

$$e = \frac{37}{2} = 18.5$$

$$= 18.5 - 13.56$$

$$e = 4.94$$

Factor of Safety against tension Condition

$$e < B/6 = 37/6$$

$$4.94 < 6.16 \text{ ok.}$$

in Tension

stress $\gamma_{hed} > 0$.

$$\gamma = \frac{EFU}{B} \left(1 + \frac{6e}{B} \right)$$

$$\gamma_{toe} = \frac{EFU}{B} \left(1 + \frac{6e}{B} \right)$$

$$= \frac{13315}{37} \left(1 + \frac{6(4.94)}{37} \right)$$

$$= 359.86 (1.801)$$

$$\gamma_{top} = 648.11 \text{ kN/m}^2$$

$$\gamma_{hed} = \frac{EFU}{B} \left(1 - \frac{6e}{B} \right)$$

$$= \frac{13315}{37} \left(1 - \frac{6(4.94)}{37} \right)$$

$$359.86 (0.199)$$

$$\gamma_{hed} = 71.613$$

$\gamma_{hed} > 0$ ok safe

Factor of safety against overturning

$$= \frac{\sum M_r}{\sum M_o}$$

$$= \frac{508938.6}{328373.2}$$

$$= 1.549 < 2 \text{ not safe}$$

$$\sum M_r > \sum M_o$$

$$508938.6 > 328373.2 \text{ ok safe}$$

⇒ FOS against sliding

$$\frac{4 \sum F_v + B \times q}{\sum F_H} > 1$$

$$= \frac{0.7 \times 13315 + 37 \times 1400}{9245}$$

$$= \frac{9320.5 + 51800}{9245}$$

$$= 6.611 > 1 \text{ ok safe.}$$