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Sec A

Subject Hydraulic structure

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Q = 1a

Ans: Reservoir:- It is a body of fresh water which is man made lake. The main difference between lake and reservoir is that lake is natural and reservoir is artificial. Reservoir is mainly used as a source of water supply. It is also used for irrigating land, furnishing power etc.

Main three types of reservoir.

- 1) Valley dammed reservoir
- 2) Bank side reservoirs.
- 3) Service reservoirs.

More economical reservoir

In all above reservoir

Bank side reservoir is most economical.

Bank side reservoir is that which is made by diverting water from local reservoirs or streams to an existing reservoir. it is economical because in this only water is diverted from a local river. there is no need of large construction of reservoir only construction is done for diversion of water.

Q1.b

Ans:- I will suggest a rock fill embankment in hilly area because rocks are easily available in hilly area as compared to other materials like clay, mud and sand etc. which are not available in hilly areas. As there are more rains in hilly areas and Rock fill dam doesnot allow water to pass through embankment

as compared to earthfill embankment in which water may penetrate. Rockfill embankment are also known as gravity structure which are easy to build and rigid structures or gravity structures are self supported by their weights.

Q2:-

Ans:: Spillway:

A spillway is a hydraulic structure built at a dam site for diverting the surplus water from a reservoir after it has been filled to its maximum capacity. Spillways are classified into different types on the basis of the arrangement of control structure. Following are the most commonly used spillway.

- Side channel spillway
- Labyrinth spillway
- Chute spillway
- Shaft spillway

- Ogee spillway
- Straight Drop spillway.
- Siphon spillway.

Most Efficient spillway  
where freezing point of  
water is less than  $-10^{\circ}\text{C}$ .

For concrete gravity dam  
"ogee spillway" are often most  
commonly used and is located  
within the dam body hence  
whenever there is surplus water  
it will be freely disposed of  
through ogee spillway along  
its ogee shaped crest

WHY?

As the spillway is an improved  
form of drop spillway and also

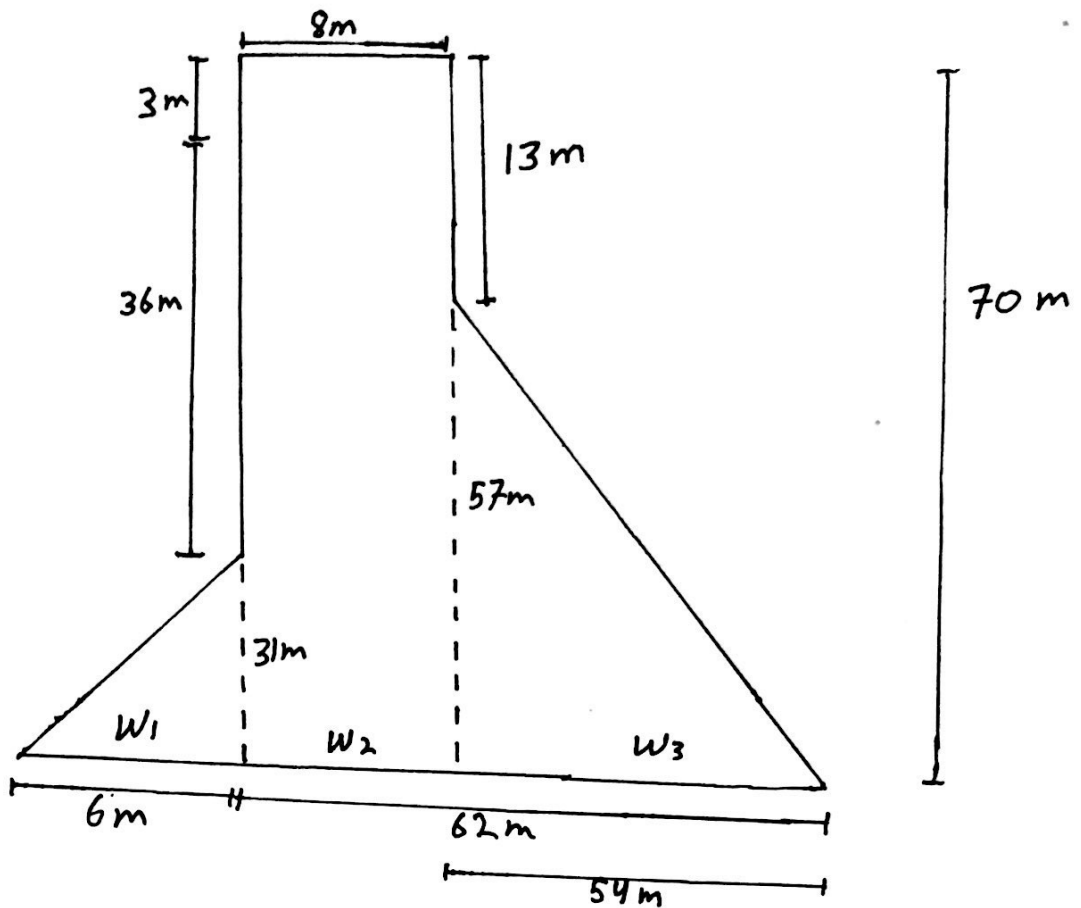
it is most commonly used in concrete gravity dam

Following are the points

- ogee spillway have very high discharging efficiency
- Have stable overflow pattern.
- Ease to pass floating debris.

"Chute spillway" is also efficient. it disposed water from upstream to the downstream through a steeply sloped open channel so that the flow will be very fast. the following water pressure will be high and will be in supercritical condition.





Force	Force calculation	$F_v$	$F_H$	$L \cdot A$	$M_r$	$M_o$
$W_1$	$\frac{1}{2} \times 6 \times 31 \times 24$	2232		$62 + \frac{6}{3} = 64$	142848	
$W_2$	$8 \times 70 \times 24$	13440		$54 + \frac{8}{2} = 58$	779520	
$W_3$	$\frac{1}{2} \times 54 \times 57 \times 24$	36936		$54 \times \frac{2}{3} = 36$	1329696	
$P_{V1}$	$\frac{1}{2} \times 6 \times 31 \times 10$	930		$62 + \frac{2 \times 6}{3} = 66$	61380	
$P_{V2}$	$6 \times 37 \times 10$	2220		$62 + \frac{6}{2} = 65$	144300	
$P_U$	$-\frac{1}{2} \times 68 \times 67 \times 10$	-22780		$68 \times \frac{2}{3} = 45.33$		1032617.4
$P_H$	$-\frac{67^2}{2} \times 10$		-22445	$67 \times \frac{1}{3} = 22.3$		506523.5

$$\Sigma F_v = 32978$$

$$\Sigma F_H = 22445$$

$$\Sigma M_r = 2457744$$

$$\Sigma M_o = 1533140.9$$

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

$$\bar{x} = \frac{2457744 - 1533140.9}{32978}$$

$$\bar{x} = 28.036 \text{ m}$$

$$e = \frac{68}{2} - 28.036$$

$$e = 5.96 \text{ m}$$

$$e < \frac{B}{6}$$

$$e < \frac{68}{6}$$

$$5.96 < 11.33 \quad \text{ok safe}$$

$$\gamma_{heel} > 0$$

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

$$\gamma = \frac{32978}{68} \left( 1 + \frac{6(5.96)}{68} \right)$$

$$\gamma_{toe} = 484.97(1.525)$$

$$\gamma_{toe} = 740.007$$

$$\gamma_{heel} = \frac{\sum Fv}{B} \left( 1 - \frac{6e}{B} \right)$$

$$= \frac{32978}{68} \left( 1 - \frac{6(5.96)}{68} \right)$$

$$= 229.93$$

$\gamma_{heel} > 0$       ok safe

$$\frac{\sum M_r}{\sum M_o} > 2$$

$$= \frac{2457744}{1533140.9}$$

1.60 < 2      not safe.

$$\sum M_r > \sum M_o$$

2457744 > 1533140.9      ok safe.

$$\frac{\mu \times \Sigma F_v + B \times q}{\Sigma F_H} > 1$$

$$\frac{0.75 \times 32978 + 68 \times 1400}{22445}$$

$$= \frac{24733.5 + 95200}{22445}$$

$$5.343 > 1 \quad \text{ok safe.}$$