Assignment/ Quiz: Hydraulic Structures

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Section B

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Q no. 1

a) Define reserviour also explian which type of reserviour will be more economical and why?

Answer No. a

A water supply scheme drawing water directly from a river or a stream may fail to satisfy the consumers demands during extremely low flows, while during high flows it may become difficult to carry out its operation due to devastating floods, a barrier in the form of dam is, therefore, constructed across the river, so as to form a pool of water on the upstream side of the dam is known as a reservoirs

Types of reservoirs

Dammed valleys

Coastal reservoir

Bank side

Service

Coastal reservoirs are fresh water storage reservoirs located on the sea coast near the river mouth to store the flood water of a river.

As the land based reservoir construction is fraught with substantial land submergence, coastal reservoir is preferred economically and technically since it does not use scarce land area. Many coastal reservoirs were constructed in Asia and Europe. Saemanguem in South Korea, Marina Barrage in Singapore, Qingcaosha in China, and Plover Cove in Hong Kong, etc. are few existing coastal reservoirs.

b) Which type of Embankment dam you will suggest in a hilly area and why?

Answer No. b

My suggestion for the hilly area is homogeneous Type because

A purely homogeneous dam is constructed using a single kind of material excluding the material used for slope protection.

And as we know that in hilly area mostly we have rocks and very little type of other soil and to avoid extra expenses rocks are easily economically available at site.

Many of the moderate-height dams are essentially homogeneous.

The material selected for such dams should be sufficiently impervious, and for stability requirements, the slope should be relatively a flat.

As mentioned above made impervious material so it will control seepage which is more dangerous in hilly area to great water pressure.

Homogeneous dams of 6 to 8 meters in height have to be provided with some type of downstream drain, which helps to reduce the pore water pressure in the downstream portion of the dam and control any seepage.

Q no. 2

List down different types of spillways also mention which type of spillway will be more efficent in a condition where freezing point of water is less then -10 degree centigrade in winters and why?

Answer

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 the control structure, a conveyance channel and a terminal structure.

Different types of spillways are as follows:

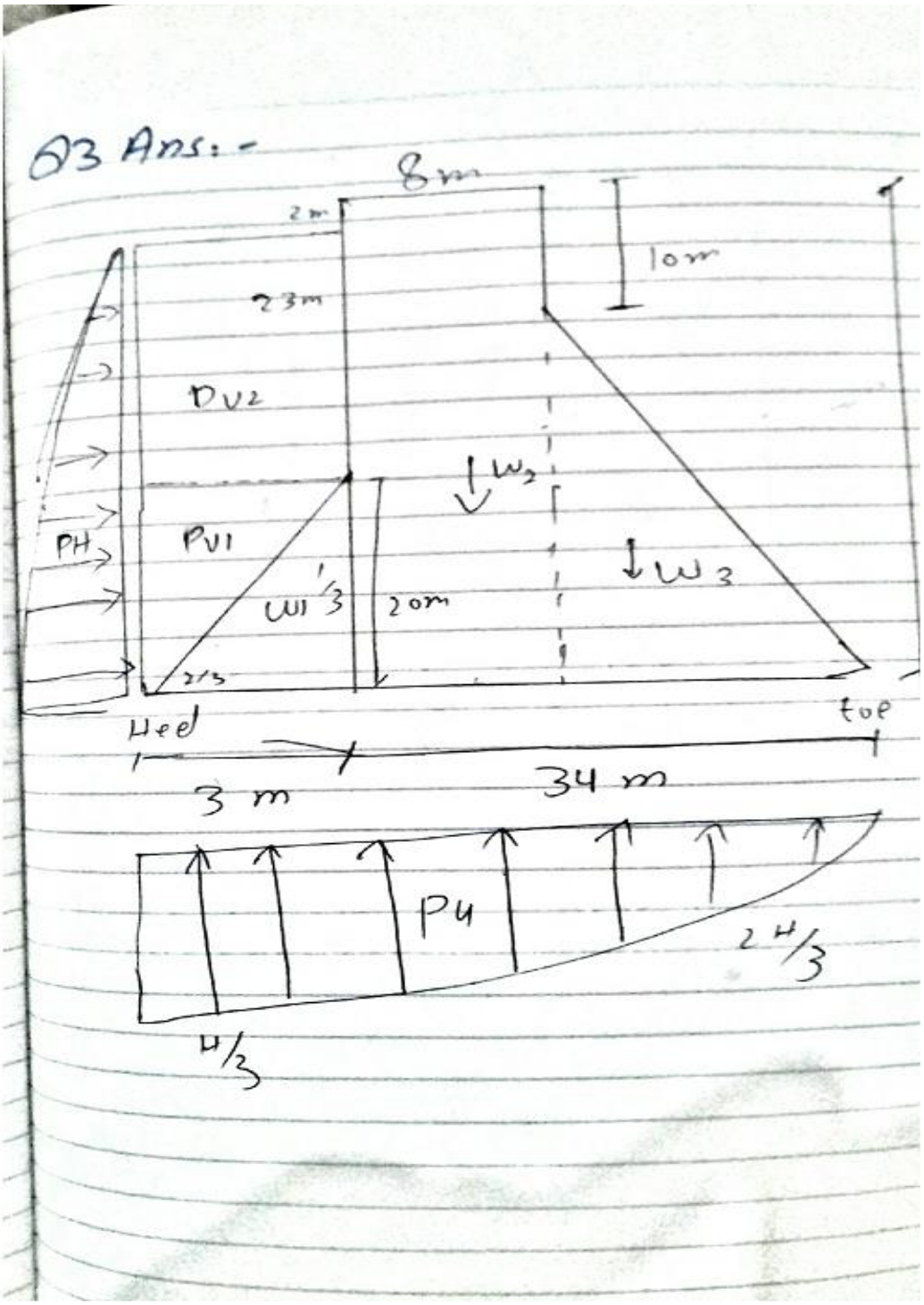
- Straight Drop Spillway.
- Ogee Spillway.
- Shaft Spillway.
- Chute Spillway.
- Side Channel Spillway.
- Siphon Spillway.
- Labyrinth Spillway.

Straight Drop Spillway

- A Straight drop spillway consists of low height weir wall having its downstream face roughly or perfectly vertical. When the water level in the reservoir rises above the normal pool level, the surplus water falls freely from the crest of the weir and hence it is known as **Straight drop spillway** or **free over fall spillway**
- This type of spillway is quietly suitable for the regions where the temperature remains down and water quickly changes to the ice due to its greater width the spillway will not be close due to the ice and don’t make damages to spillway as well as provide free flow the water cum ice, all other type of spillway are not for the condition mentioned due its small and narrow width.

Q no. 3

Desgin the gravity dam by assuming the dam dimenssions, find all the stability checks at least three of them must be in a safe condition and economical. In reserviour full condiotion considering wight of dam, water pressure and uplft pressure.



Force	Force cal	FV (kN)	FH	lever arm	M_1	M_0
W_1	$\frac{1}{3}\times 3\times 20\times 24$	720		$34+3\times\frac{1}{3}$ $=35$	720×35 $=25200$	
W_2	$8\times 45\times 24$	8640		$26+\frac{8}{2}$ $=30$	8640×30 $=259200$	
W_3	$\frac{1}{2}\times 35\times 26\times 24$	10920		$26\times\frac{2}{3}$ $=17.33$	17.33×10920 $=189243.6$	
P_{V1}	$\frac{1}{2}\times 20\times 3\times 10$	300		$34+\frac{3\times 2}{3}$ $=36$	$300\times 36=$ 10800	
P_{V2}	$23\times 3\times 10$	690		$34+\frac{3}{2}$ $=35.5$	35.5×690 $=24495$	
P_H	$-\frac{1}{2}\times 37\times 48\cos$	-7955		$37+2$ $=24.66$		1961703
P_H	$-\frac{43^2}{2}\times 10$	[redacted]	$=9245$	$\frac{43}{3}=14.3$		132203.5

ΣF_V [redacted] 13315 $\Sigma F_H = -9245$ $\Sigma M_1 = 508938.6$ $\Sigma M_0 = 3283738$

Eccentricity of resultant force

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

$\bar{X}$ = location of resultant from toe

$$\bar{x} = \frac{\Sigma M_x - \Sigma M_o}{\Sigma F_v}$$

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

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

$$\bar{x} = 13.56$$

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

$$e = \frac{37}{2} - 13.56$$

$$18.5 - 13.56$$

$$e = 4.94$$

Factor of safety Against Tension condition

$$e < B/6 \qquad 37/6$$

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

in Tension

stress $Y_{med} > 0$

$$Y = \frac{\Sigma F V}{B}\left(1 \pm \frac{6e}{B}\right)$$

$$Y_{toe} = \frac{\Sigma F V}{B}\left(1 + \frac{6e}{B}\right)$$

$$= \frac{13315}{37}\left(1 + \frac{6(4.04)}{37}\right)$$

$$= 359.86 \quad (1.801)$$

$$\boxed{Y_{toe} = 648.11 \text{ kN/m}^2}$$

$$Y_{med} = \frac{\Sigma F V}{B}\left(1 - \frac{6e}{B}\right)$$

$$\frac{13315}{37}\left(1 - \frac{6(4.04)}{37}\right)$$

$$359.86 \quad (0.199)$$

$$Y_{med} = 71.613$$

$Y_{med} > 0$ ok safe

factor of safety against over turning

$$\frac{\Sigma M_s}{\Sigma M_o} > 2$$

$$\frac{508938.6}{328373.8}$$

$1.549 < 2$ not safe

$\Sigma M_s > \Sigma M_o$

$508938.6 > 328373.8$ ok safe

FOS against sliding

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

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

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

$6.611 > 1$ ok safe