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Section = "B"

Subject = Hydraulic structure

Exam = Mid term

Q1 Ans:- Reservior
(a)

Reservior is a man made or large fresh water body of water. many people think of a reservior as a lake and might even use the word interchangeably. However the key difference is that reserviors are artificial and made by human while lake are naturally occuring bodies of water. Reserviors are great because they provide a supply water for when naturally occurring bodies of water like lakes or rivers, run dry

Types of reservior
→ valley-damned reserviors
→ bank side reservoirs
→ service reservoirs.

(2)

⇒ Bank side reservoirs is economical reservoirs because the material of construction are available easily & approachable, transport facilities, and the excavation cutting & fill cost are also economical compair to valley dammed reservioirs & service reservioirs

→ In valley dammed yeservioir has high amount of cutting filling in rock and also high amount of transportation charges etc

→ In service reservioir has havey fundation and also heavy structure tank so it is uneconomical

Q1(b)

In hilly area I suggest Zone type embankment dam

→ The material for pervious zone may be sand gravel, cobbles or rock or mixture of these material

→ The width of core is controlled by availability of material and design required such as stability & seepage

→ And the major part of dam is composed of rock it classified as rockfill dam.

→ this type is economical also as compair to other type of Embankment dam.

Q2 Ans

Types of spillways :=>

1. Straight Drop spillway
2. Ogee spillway
3. Shaft spillway
4. chute spillway
5. Side channel spillway
6. Siphon spillway
7. Labyrinth spillway

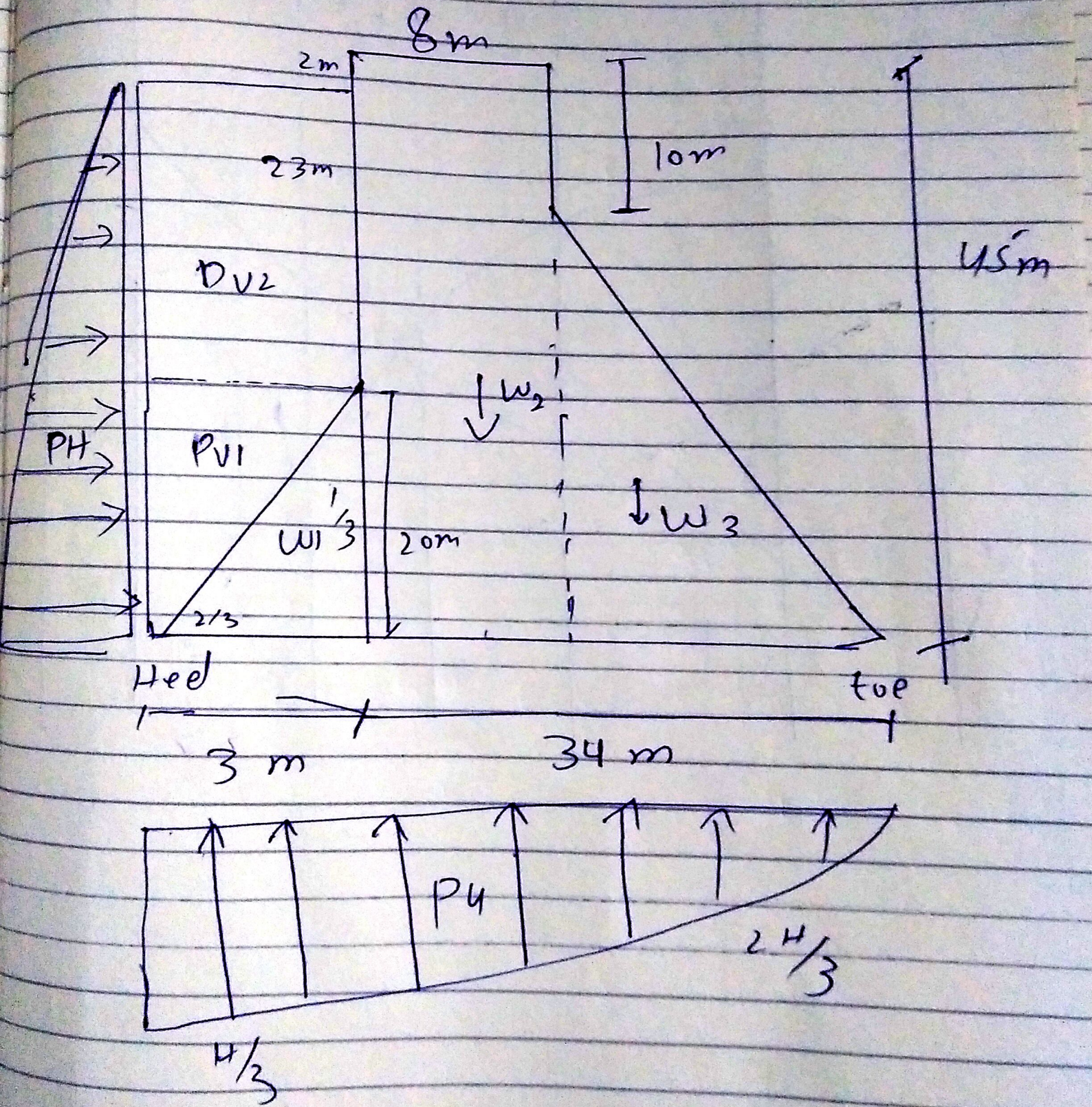
Chute spillway :-

-> Chute spillway is the type of spillway in which the surplus water from upstream is disposed to the downstream through a steeply sloped open channel.

-> So this type of spill way will be more efficent in a condition where freezing point of water is less than 10 degree centigrade in winter

-> 4°c the water converted to ice form started, So the chute spill-way have steep slope and easly ice come to down stream and dam is safe from failure due to extra load of ice.

Q3 Ans:-


8m
2m
23m
10m
45m
DV2
W2
PH
PV1
W1
1/3
W3
20m
2/3
Heel
toe
3 m
34 m
P4
2H/3
H/3

Force	Force cal	FV (kN)	FH	lever arm	Mx	Mo
W1	$\frac{1}{3}\times 3\times 20\times 24$	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_{U1}	$\frac{1}{2}\times 20\times 3\times 10$	300		$34+\frac{3\times 2}{3}$ $=36$	$300\times 36=$ $10\,800$	
P_{U2}	$23\times 3\times 10$	690		$34+\frac{3}{2}$ $=35.5$	35.5×690 $=24495$	
P_H	$-\frac{1}{2}\times 37\times 43\times 10$	-7955		$37\times\frac{2}{3}$ $=24.86$		196170.3
P_H	$-\frac{43^2}{2}\times 10$	[redacted]	$=9245$	$\frac{43}{3}=14.3$		132203.5

ΣF_V = [redacted] 13315 $\Sigma F_H = -9245$ $\Sigma M_1 = 508938.6$ $\Sigma M_o = 328373.8$

Eccentricity of resultant force

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

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

$$\bar{x} = \frac{\Sigma M_R - \Sigma M_O}{\Sigma F_V}$$

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

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

$$\bar{x} = 13.56$$

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

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

$$18.5 - 13.56$$

$$e = 4.94$$

Factor of safety Against Tension condition

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

$$4.94 < 6.16$$ ok

in Tension

Stress $\gamma_{heel} > 0$

$$\gamma = \frac{\Sigma FV}{B}\left(1 \pm \frac{6e}{B}\right)$$

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

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

$$= 359.86 \quad (1.801)$$

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

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

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

$$359.86 \quad (0.199)$$

$$\gamma_{heel} = 71.613$$

$\gamma_{heel} > 0$ ok safe.

Factor of safety against over turning

$$\frac{\Sigma M_1}{\Sigma M_0} > 2$$

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

$1.549 < 2$ not safe

$\Sigma M_1 > \Sigma M_0$

$508938.6 > 328273.8$ 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