Name=inam ul hassan

Id=7693

Exame=mid 2020

Paper= hydraulic structure

Question 1 part a

Definition = reservoir is a lake made by man . it's a larger fresh water body

ECONOMICAL RESERVOIR

1=service reservoir is most economical because they are man made

2=its construction is easy to do as well as no need

of natural water body

3=service reservoir need less space for construction

4=in some places people dig cisterns , cisterns must be in place of higher elevation to allow water to flow where need to go

5=water towers are alwas at higher location than surrounding land

QUESTION 1 PART B

Due to following reasons I suggest rockfill dam

1=rockfill embarkments are used in hilly area because rock fill dams are embarkment of compact granular soil in combination of impervious area

2=rockfill have gravel and coarse rock , ccrushed rock and dimesnions are 2 to 600 mm

3=homogenous type of dam composed of entirely single material ,require flat slopes because of weak foundation

4= particle size , nature and permeability of this dam is best for hilly areas

VARIANTS OF ROCKFILL DAM

1=control vertical clay CORE

2=inclined clay core with drains

3=decked with asphalt or concrete membrane on upstream face with drains

CLASSIFICATION OF ROCK FIILL

1=zoned earthfill with rockfill

2=zoned rockfill centrail core

3= rockfill with membrane

QUESTION 2 PART A

SPILLWAYS : spillway is channel or passage way through which food or surplus escape safely from reservoir

TYPES OF SPILLWAYS

1=STRAIGHT DROP SPILLWAYS ;:

Straight drop sipillways consist of low height weir wall having no downstream face roughly or perfectly vertical

2=OGEE SPILLWAYS : ogee spillwaway is ogee shaped and mostly used . and applicable in gravity dam ,arch dam etc .several rockfill dams are provided with this type of spill way as superstructure

3-SHAFT SPILLWAYS : shaft spill way consist of horizontal crest and vertical shaft with its top surface and at crest level of spillways and its lower end connected to vertical shaft . the other end of vertical shaft is connected to horizontal conduit or tunnel which extend through or around the dam

And carry water to river downsteam and used at that sites where conditions are not favourable for overflow

4=CHUTE SPILLWAYS

> Chute spillway is spillway in which surplus water from upstream is disposed to downstream through a steepy sloped open channel . its generally constructed at one end of dam or separately away from dam in natural saddle in a bank of river .

> Chute spillway is suitable for gravity dam

> the slope of chute spillway is designed in such a way that flow should always in super criticle condition

5=SIDE CHANNEL SPILLWAY :

> side channel spillway is similar to chute spillway but only difference in crest of side channel spillway is located on one of its sides whereas crest of chute spillway is located between of side walls

6=SIPHON SPILLWAYS:

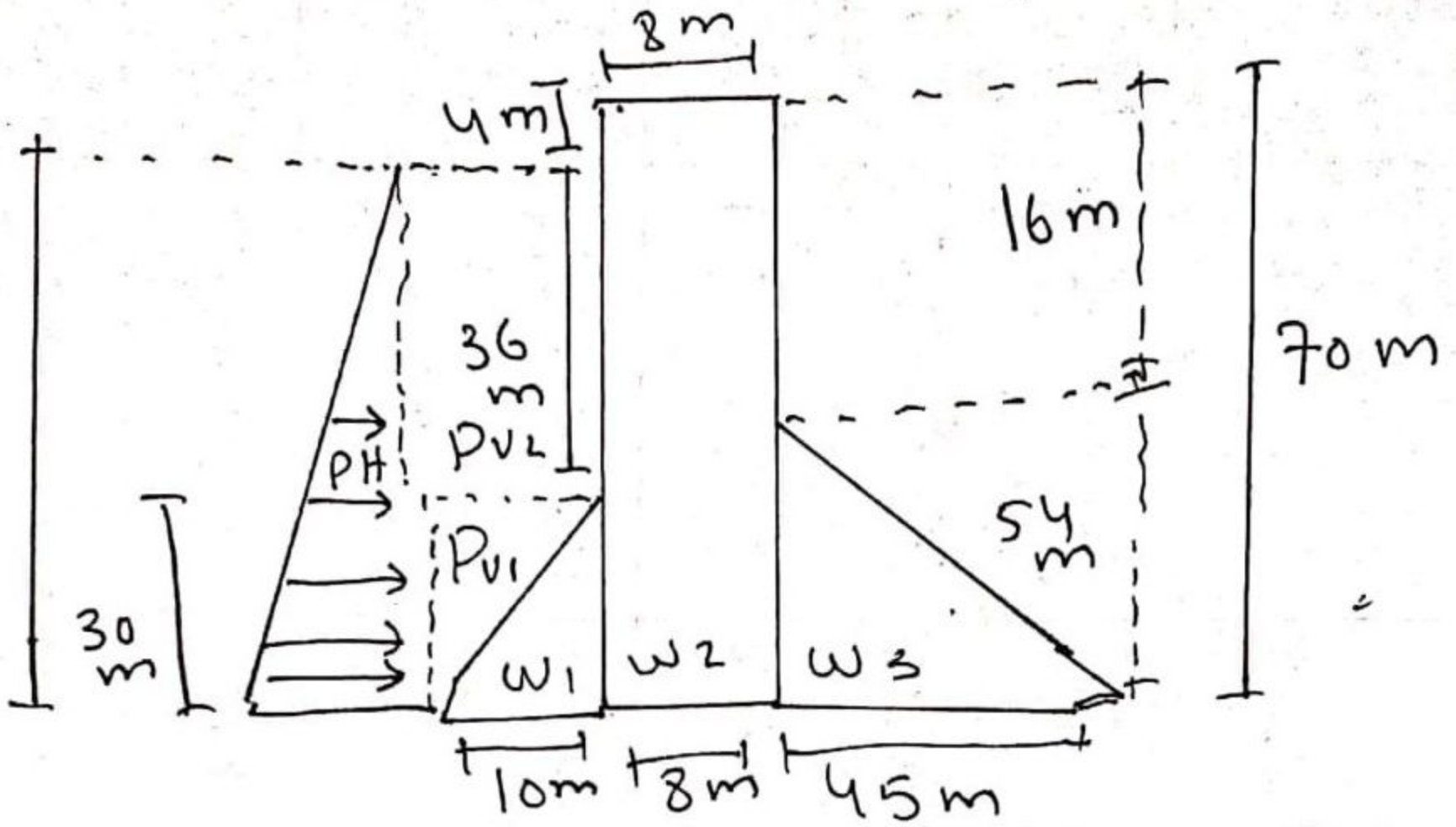
> in this spillway surplus water is disposed to downstream through an inverted u shapd conduit . it is generally arranged inside body or over crest of dam

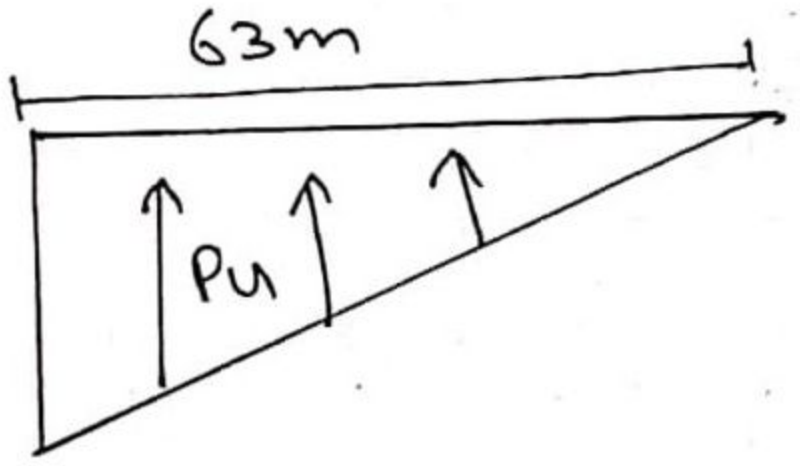
> in both type of siphon spillway air rents are provide at bent portion of upper passage way to prevent entrance of water when water level is below normal pole level

7=LABRYNTH SPILLWAYS :

- It is a type of spillways in which weir wall is constructed in zigzag manner in order to increase effective length of weir crest with respect to channel width .
- This increase in effective lengtht raises discharge capacity of weir and heence higher water flow at small heads can be conveyed to downstream easily

Question (3)





Solution

⇒ Assume unit weight for water = 10 KN/m³

⇒ Assume unit weight for concrete = 24 KN/m³

Now force and moment calculation

Forces	Force formula	FV(KN)	FH(KN)	Lever Arm	Mr	Mo
W_1	$1/2 \times L \times W \times \gamma_d$	3600	0	56.33	202800	0
W_2	$L \times W \times \gamma_d$	13440	0	49.0	658560	0
W_3	$1/2 \times L \times W \times \gamma_d$	2916.0	0	30.0	874800	0
P_{V_1}	$1/2 \times L \times W \times \gamma_w$	1500	0	59.67	89500	0
P_{V_2}	$L \times W \times \gamma_w$	3600	0	58.00	208800	0
P_V	$(-(1/2) \times L \times W \times \gamma_w$	-2079.0	0	42.0	0	873180
P_n	$((-\frac{1}{2}) \times L \times W \times \gamma_w)$	0	-2178.0	22.0	0	479160
	Σ	30510	-21780	Σ	2034460	1352340

⇒ Factor of safety against tension condition is $e < B/6 \rightarrow B/6 = 10.50m$

⇒ Eccentricity of resultant force will

$e = B/2 - \bar{x} \longrightarrow (1)$

$\bar{x}$ is location of resultant force from toe

$$\Rightarrow \bar{x} = \frac{\Sigma M_r - \Sigma M_o}{\Sigma F_v} = \frac{2034460 - 1352340}{30510}$$

$$\Rightarrow \bar{x} = 22.36$$

Put values and we get

$$e = \frac{63}{2} - 22.36 \Rightarrow \boxed{e = 9.14\,m}$$

And condition → safe in tension → ok

⇒ for factor of safety against stress

→ Condition → $\gamma_{Heel} > 0$

Now $\gamma = (\Sigma F_v / B)(1 \pm 6e/B) \longrightarrow (A)$

Now from eq (A) we get

$\Rightarrow \gamma_{toe} = (905.9728)\ KN/m^3$

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

$$= \left(\frac{30510}{63}\right)\left(1 - 6 \times \frac{9.14}{63}\right) = \boxed{62.72\ KN/m^3}$$

Condition → safe in stress → ok

⇒ for factor of safety against over turning condition → $(\Sigma M_r / \Sigma M_o) > 2$

$$\frac{2034460}{1352340} = 1.50 \not> 2$$

Condition not safe in over turning

⇒ Condition $\Sigma M_r > \Sigma M_o$

$\Sigma M_r = 2034460$

$\Sigma M_o = 1352340$

Condition → safe → ok

⇒ Now factor of safety against sliding

Condition → $\left(\frac{\mu \Sigma F_v + Bq}{\Sigma F_H}\right) > 1$

$q = 1400$, $\mu = 0.7$

Put values we get

$$= \frac{0.7 \times 30510 + 63 \times 1400}{21780}$$

$= 5.037 > 1$

Condition : safe in sliding