

IQRA NATIONAL UNIVERSITY
Department of Civil Engineering
Mid - Term Examination

NAME:-

Muhammael Abdullah Khan

REG#:-

7720

SEMESTER:-

8th

SECTION:-

B.

SUBJECT:-

Hydraulic Structure.

Instructor:-

Mr. Engo Adeel.

a)

Question # 01:-

Define reservoir also explain which type of reservoir will be more economical and why?

Ans-

Reservoirs:-

A reservoir is a man-made lake or large freshwater body of water many people think of the reservoir as a lake and might even use the words interchangeably. However the key difference is that the reservoirs are artificial and made by humans while on the other hand lakes are naturally occurring bodies of water.

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

Economical type of

Reservoir:-

The most economical type of Reservoir is valley Dammed Reservoir because of the following reasons:

Benefit to Cost Ratio:-

Generally speaking the benefit to cost ratio of valley dam reservoir is high as compared to other type of reservoirs.

If for a populated township we had to design a water supply scheme and let's say we require 30 service reservoirs but contrary to this we construct a single valley dam reservoir which will be more economical and then no need for providing so many service reservoirs.

2- Storage Capacity:-

The valley dam reservoirs may takes years to built the water pools in the valley and it has a large storage capacity of water as compare to other types of reservoirs.

3- Less Maintenance:-

valley dam reservoir is functional for a large period of time without maintenance as compare to the other types reservoirs.

b.)

Which type of Entertainment dam you will suggest a hilly area and why?

Ans:

The type of entertainment that I will suggest in a hilly area is Rock fill Entertainment because of the following reasons;

1- Availability of Material:

As rock fill entertainment consist of 50% of material as rocks. As rocks are easily available in hilly areas as compared to clay or sand which are not or rarely available in hilly areas as compared Embankments is hilly rocks and areas also saves transportations charges and hence it becomes economical also.

2- Stability of Embankment:-

(~~embankment~~^{embankment}) embankment are also known as gravity structure which are easily to build and rigid structure are self supported by their weight. Rockfall

Anilly areas the ground is rock type material and cannot bear the earth fill embankment because there are more chances of sliding. of embankment whenever earth fall embankment is constructed over rocky ground surface.

3-

Strength of Embankment:-

The strength of rock fill embankment is more as compared to earth fill embankment

As there are more rains in (highly) willy areas and rockfill embankment is tightly bonded and does not allow the water to pass through as compared to earth fill embankment in which water may penetrate during heavy floods.

Question # OR:

List down different types of spillways, also mention which type of spillway will be more efficient in a condition where freezing point of water is less than -10°C in winters & why?

Ans) Types of spillway:-

- 1- Straight drop spillway.
- 2- Ogee spillway.
- 3- Sluice spillway.
- 4- chute spillway.
- 5- side channel spillway.
- 6- siphon spillway.
- 7- Labyrinth spillway.

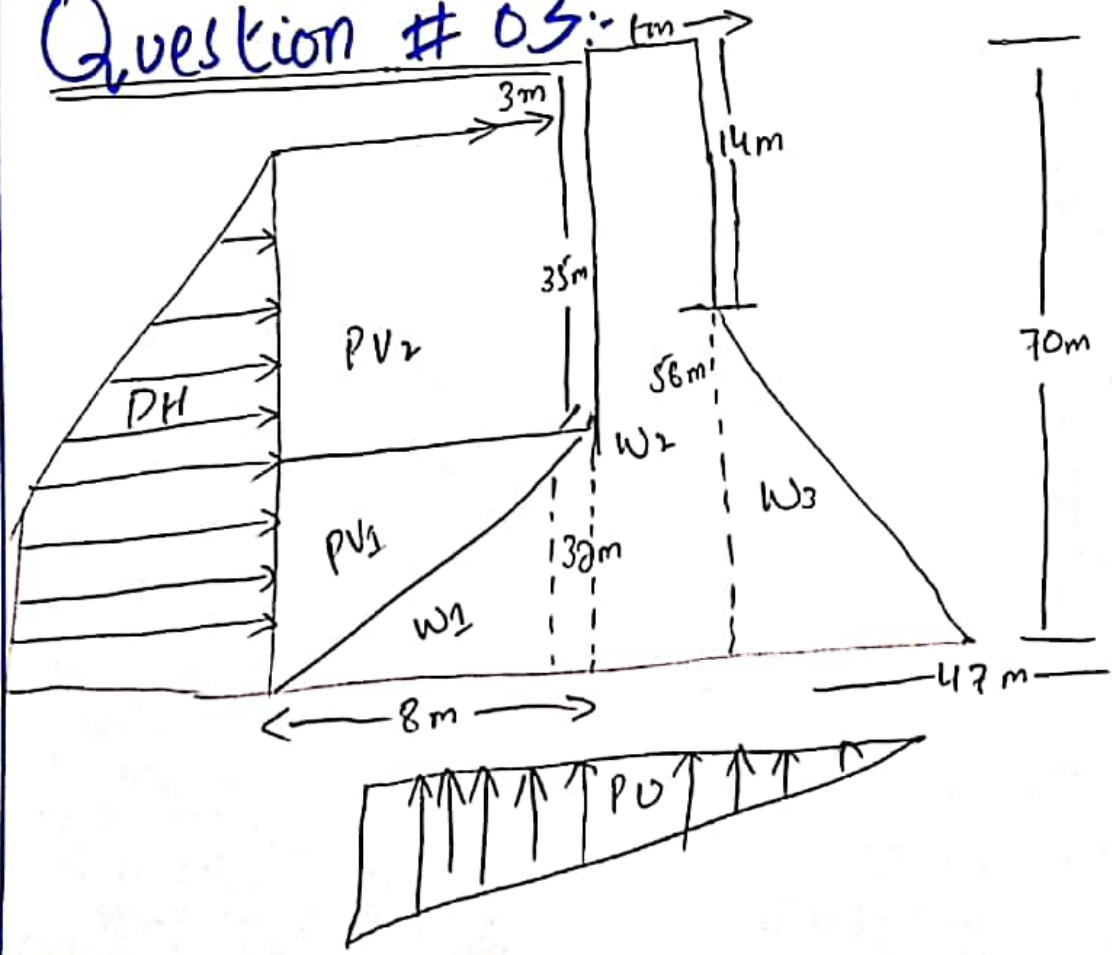
The type of spillway that I will suggest for regions where temperatures in winters fall upto 10°C is chute spillway because of the following reasons.

- 1- The slope of the chute spillway is very steep and the water flows

and doesnot freezes due to steep slope and the kinetic energy, increases the temperature of water.

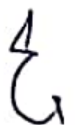
2- The water flows from chute spillway with high pressure and will be in supper critical condition. Hence the energy of water is dissipated through dissipators provided in chute spillway. Once the energy does'nt freezes and the structure will not be in danger.

Question # 03:-



Assumptions:-

- Unit weight of concrete, $\gamma_c = 24 \text{ kN/m}^3$
- Unit weight of water, $\gamma_w = 10 \text{ kN/m}^3$
- $q = 1400$.

forces	forces Calculation	F_v (kN)	F_H	Lever Arm	Resisting moment M_r	Overturning Moment M_o
W_1	$\frac{1}{2} \times 8 \times 32 \times 24$	3072		$541 \frac{2}{3} = 56.67$	$3072 \times 56.67 = 174090.24$	
W_2	$7 \times 70 \times 24$	11760		$47 + \frac{7}{2} = 50.5$	11760×50.5	
W_3	$\frac{1}{2} \times 47 \times 56 \times 24$	31584		$54 + \frac{2 \times 2}{3} = 59.33$	$31584 \times 59.33 = 1882952.67$	
P_{v1}	$\frac{1}{2} \times 8 \times 32 \times 10$	1280		$54 + \frac{2}{2} = 56$	$1280 \times 56 = 71680$	
P_{v2}	$35 \times 8 \times 10$	2800		$67 + \frac{2}{3} = 70.33$	$2800 \times 70.33 = 196924$	
P_u	$\frac{1}{2} \times 67 \times 67 \times 10$	-20770		$\frac{67}{3} = 22.33$	$20770 \times 22.33 = 463894.1$	
P_H	$\frac{67^2}{2} \times 10$		-22445	$47 + \frac{7}{2} = 50.5$		$22445 \times 50.5 = 1133472.25$
		29726	Shree		1995831.36	1359620.95

Eccentricity of the Resultant force:

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

$$\bar{x} = \frac{\sum M_1 - \sum M_0}{\sum F_v}$$

$$\bar{x} = \frac{1995239.36 - 1359620.79}{29726}$$

$$\boxed{\bar{x} = 21.4}$$

So,

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

$$e = \frac{62}{2} - 21.4$$

$$e = 9.6 \text{ m.}$$

Factor of Safety against tension.

Condition:-

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

$$e < \frac{6.2}{6}$$

$$\boxed{9.6 < 10.3}$$

ok
→ so dam structure is safe in tension.

Stresses:-

Condition:-

$$\gamma_{heel} > 0$$

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

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

$$\gamma_{toe} = \frac{29726}{6.2} \left(1 + \frac{6(9.6)}{6.2} \right)$$

$$\boxed{\gamma_{toe} = 924.9 \text{ KN/m}^2}$$

$$\sigma_{\text{heel}} = \frac{\sum F_v}{B} \left(1 - \frac{6e}{B} \right)$$

$$= \frac{29726}{62.8} \left(1 - \frac{6(4.6)}{62} \right)$$

$$\sigma_{\text{heel}} = 34.03$$

So, $\sigma_{\text{heel}} > 0$ ok

→ Dam structure is safe in bearing the stresses.

Factor of Safety Against Overturning:

Condition 1:

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

$$= \frac{1995839.36}{1359620.95}$$

So, The condition is not safe and there are chances for dam to overturn.

Condition 2:-

$$\sum M_r > \sum M_o$$
$$1995839.36 > 1359620.95$$

OK! safe

Factor of safety against sliding:-

Condition:-

$$\mu \times \sum F_v + B \times q / \sum F_H > 1$$

$$\frac{0.75 \times 29726 + 62 \times 1400}{20445}$$

4.86

So, $4.86 > 1$ hence dam structure will resist sliding.

