

Assignment / Quiz

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Subject : Hydraulic Structures

Program : BE(C)

Section : "B"

Lecturer :- Engr. Adeed Khan

Exam :- Mid Paper

Q NO 1: part (a)

Ans:

Reservoir:-

"A reservoir is a man-made lake or large fresh water body of water."

OR

"A reservoir is storage space of water."

→ Reservoir have mainly three types;

①: Valley-dammed reservoir.

②: Bank-side reservoir.

③: Service reservoir.

⇒ Service reservoir is more economical than others.

WHY?:

It is economical because it is entirely man-made reservoir. Its frame construction is easily to design & construct. And also no need of any natural water body diversion. And the most important thing is this that Service reservoir required small space.



Q1: part (b):

Ans: Embankment dam have two types of dams:

- ① Earth fill embankment.
- ② Rock fill embankment.

⇒ I will suggest Rock fill embankment dam in hilly area.

WHY?

Rock fill embankments are the one which consist of 50% or more rock. In hilly area, we should build rock fill embankment because rock fill embankment have more strength than earth fill embankments. And also in hilly areas rocks will be easily available. Which will make our project economical and safe.

Q NO (2): (a):

Ans:

* Types of spill ways:

- ①: Straight Drop spill way.
- ②: Ogee (overflow) spill way.
- ③: Shaft spill way.
- ④: Chute spill way.
- ⑤: Side channel spill way.
- ⑥: Siphon spill way.
- ⑦: Labyrinth spill way.

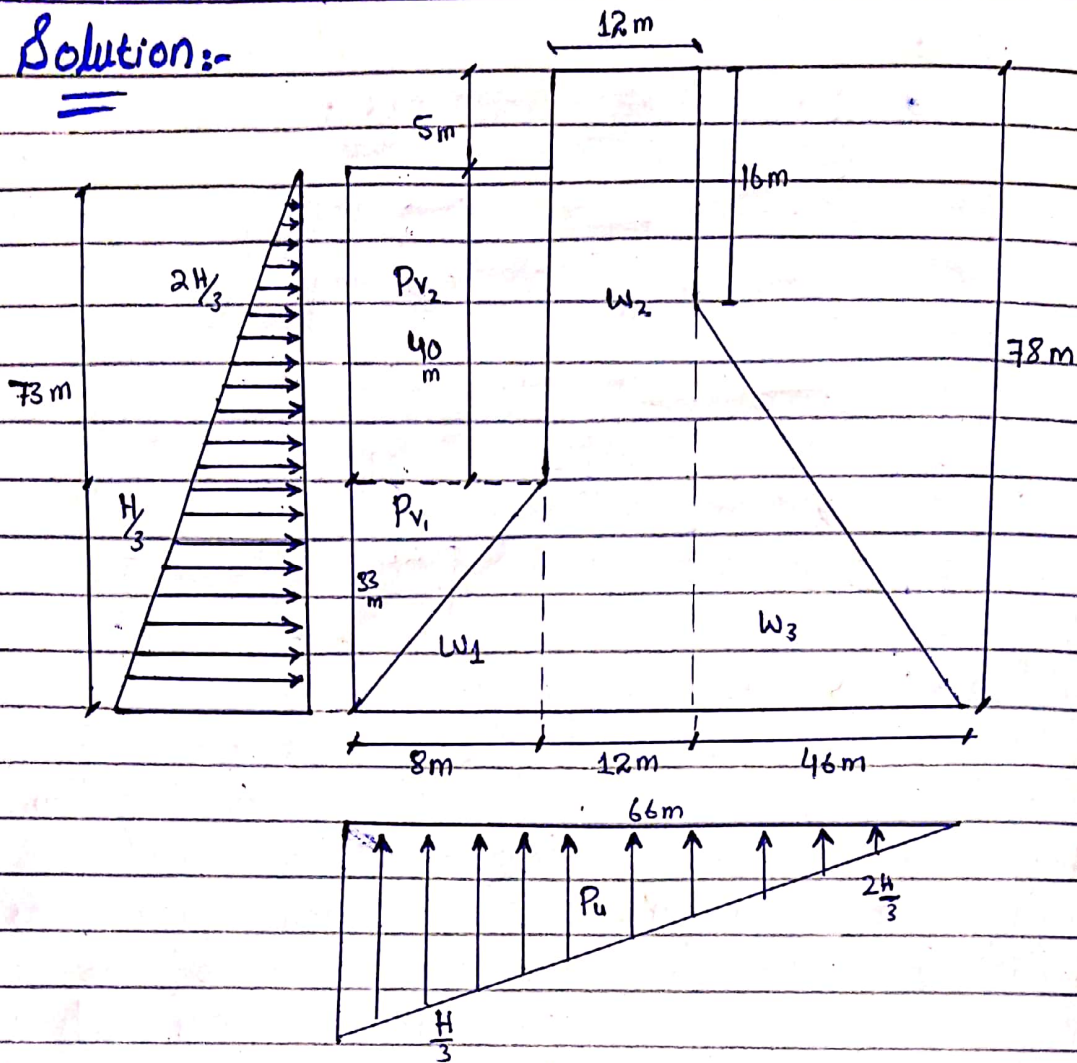
* Straight Drop spill way:-

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 its known as straight drop spillway or free over fall spill way.

→ 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):

Solution:-



We assume all the data:

→ Assume unit weight of concrete = 24 kN/m^3

→ Assume unit weight of water = 1.0 kN/m^3

→ $\mu = 0.7$

→ $\gamma = 1400$

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Force & Moment Calculation:

| Force | Force calculation | F_v (kg) | F_H (kg) | Lever arm | M_y | M_x |
|----------|---|------------|------------|-----------|------------|-----------|
| W_1 | $\frac{1}{2} \times 8 \times 33 \times 24$ | 3168 | 0 | 60.67 | 192202.56 | |
| W_2 | $12 \times 78 \times 24$ | 22464 | 0 | 40 | 898560 | |
| W_3 | $\frac{1}{2} \times 46 \times 62 \times 24$ | 34224 | 0 | 30.67 | 1049650.08 | |
| P_{v1} | $\frac{1}{2} \times 8 \times 33 \times 10$ | 1320 | 0 | 63.33 | 83595.6 | |
| P_{v2} | $8 \times 40 \times 10$ | 3200 | 0 | 62 | 198400 | |
| P_v | $\frac{1}{2} \times 66 \times 73 \times 10$ | -24090 | 0 | 44 | | 1059960 |
| P_H | $\frac{69^2}{2} \times 10$ | 0 | -26645 | 24.3 | | 647473.5 |
| Σ | | 40286 | -26645 | | 2422408.24 | 1707433.5 |

⇒ For factor of safety against tension condition:

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

$$\frac{B}{6} = \frac{66}{6} = 11m$$

⇒ eccentricity of resultant force;

$$e = \left(\frac{B}{2}\right) - \bar{x}$$

\bar{x} = location of resultant



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→ force from toe;

$$\bar{x} = \frac{\sum M_x - \sum M_o}{\sum F_x}$$

$$\bar{x} = \frac{242208.24 - 1707433.5}{40.286}$$

$$\bar{x} = 22.75$$

Now;

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

$$e = \frac{66}{2} - 22.75$$

$$e = 10.5 < \frac{B}{6}$$

Condition → safe in tension.

⇒ For factor of safety against stress;

$$Y_{heel} > 0$$

$$Y_{Tee} = \left(\frac{\sum F_x}{B} \right) \left(1 + \frac{6e}{B} \right)$$

$$Y_{Tee} = \left(\frac{40286}{66} \right) \left(1 + \frac{6 \times 10.25}{66} \right)$$

$$Y_{Tee} = 1456.62$$

⇒

⑦

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

$$Y_{heel} = -235.84 < 0$$

Condition \rightarrow not safe.

\Rightarrow For factor of safety against overturning:

$$\text{Condition } \left(\frac{\sum M_r}{\sum M_o} \right) > 2$$

$$= \frac{2422408.24}{1707433.5} = 1.41 < 2$$

Condition \rightarrow not safe.

\Rightarrow The other condition ($\sum M_r > \sum M_o$)

$$\sum M_r = 2422408.24$$

$$\sum M_o = 1707433.5$$

Condition \rightarrow safe ok



⇒ Factor of Safety against sliding;

$$\text{Condition} \Rightarrow \frac{\mu \sum F_v + B \times q}{\sum F_H} > 1$$

$$= \frac{0.7 \times 40286 + 66 \times 1400}{26645}$$

$$= 4.53 > 1$$

Condition → Safe in sliding.

Hence the three condition are at least safe.

* — * (decorative line)