Q1(a) Define reservior also explain which type of reservior will be more economical and why?

*:: RESERVIOUR :-

A reservioux is a man made lake or large fresh water body of water. Many people think of a reservioux as a lake and might even use the words interchangeably. However, the key difference is that reservioux are artificial and lakes are naturally.

*:: TYPES :-

There are mainly three types of reservioux;

(1) Valley damed reservioux
(2) Bank-side reservioux
(3) Service reservioux

In above three types, Service reservioux is most economical because it is entirely man made. Its frame construction is easy to construct as well as no need of any natural water body diversion. It also required small space.

Q1(b) which type of embankment dam you will suggest in a hilly area and why?

Ans) There are types of embankment dams.

:: TYPES ::

(1) Earth fill embankments
(2) Rock fill embankments

Earth fill embankments are the one which consist of 50% or more soil while **rock fill** embankments are the one which consist of 50% or more rock. "If we have to build an embankment in a hilly area, we should build **rock fill** embankments because rock fill embankments have more strength then earth fill embankment and in hilly area rock will be easily available which will make our project economical and save.

Q2) 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 degree centigrade in winters and why?

Types Of Spillways :-

Different types of spillways:

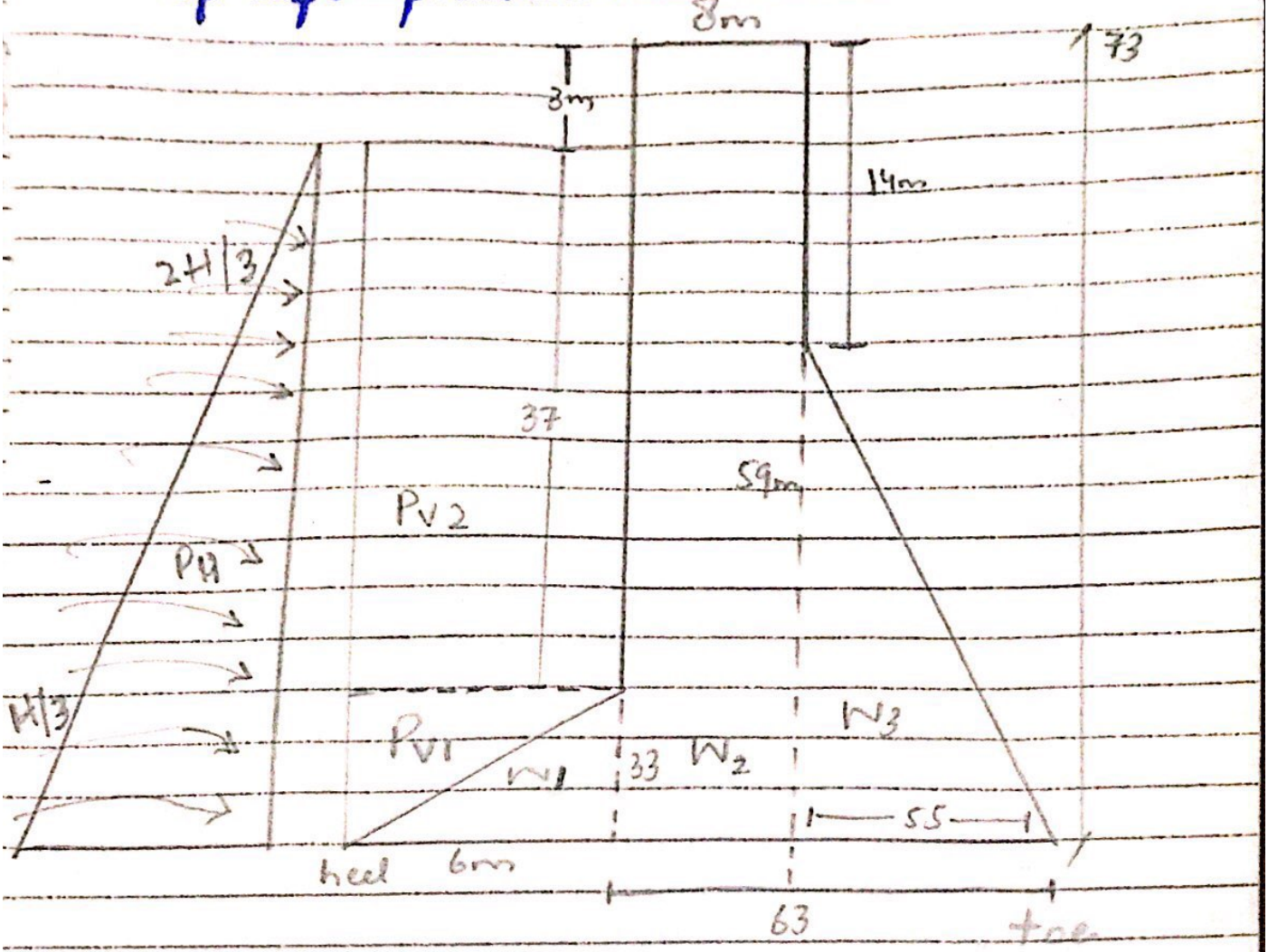
(1) Strength drop Spillway
(2) ogee Spillway
(3) chute spillway
(4) Siphon Spillway
(5) shaft spillway
(6) Side channel spillway
(7) Labyrinth Spillway

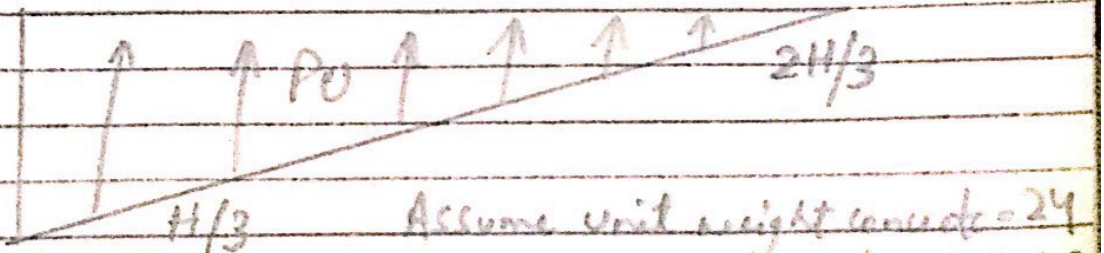
→ ogee Spillway is generally more efficient in a condition where freezing point of water is less than -10 degree centigrade because the downstream profile of the Spillway is made to coincide with the shape of the lower nappe of the free falling jet from the sharp crested weir. In this shape the lower nappe is similar to a projectile and hence downstream surface of the ogee Spillway will follow parabolic path where "O" where "O" is the origin of parabola.

→ ogee Spillway is also best for their condition because in this temperature the head is

maximum and when the spillway run with maximum head, the overflowing water just follow the curve profile of the spillway and there is no gap between the water & spillway surface so discharge is maximum.

Q3) Design the gravity dam by assuming the dam dimensions. Find all the stability checks at least three of them must be in a safe condition and economical. In reservoir full condition considering weight of dam, water pressure and up lift pressure.





Assume unit weight concrete = 24
" " " water = 10 kN/m³

Forces	Forces calculation	F_V	F_U	L.A	M_Y	M_D
W_1	$1/2 \times 6 \times 33 \times 24$	2376	0	$63 + 6/3 = 65$	154440	0
W_2	$8 \times 73 \times 24$	14016	0	$55 + 8/2 = 59$	826944	0
W_3	$1/2 \times 55 \times 59 \times 24$	38940	0	$55 \times 2/3 = 36.67$	1427929.8	0
P_{V1}	$1/2 \times 6 \times 33 \times 10$	990	0	$63 + \frac{2 \times 6}{3} = 67$	66330	0
P_{V2}	$6 \times 37 \times 10$	2220	0	$63 + 6/2 = 66$	146520	0
P_U	$-1/2 \times 69 \times 70 \times 10$	-24150	0	$69 \times 2/3 = 46$	0	1110900
P_H	$-70^2/2 \times 10$	0	-24500	$70 \times 1/3 = 23.3$	0	570850
		$\Sigma F_V = 34392$	$\Sigma F_H = 24500$		$\Sigma M_Y = 2622163.8$	1681750.0

Eccentricity of Resultant force: $e = \frac{B}{2} - \bar{n}$

$$\bar{n} = \frac{2622163.8 - 1681750.0}{34392}$$

$$\bar{n} = 27.34\,m$$

$$e = \frac{69}{2} - 27.34$$

$$e = 7.16\,m$$

★ :- CONDITION :-

→ (Factor of safety against tension)

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

$$e < \frac{69}{6}$$

$7.66 < 11.5$ Safe ok!

→ $\gamma_{heel} > 0$ (Factor of safety against stress)

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

$$\gamma_{toe} = \frac{\Sigma F_V}{B}\left(1 + \frac{6e}{B}\right) \Rightarrow \frac{34392}{69}\left(\frac{1 + 6(7.16)}{69}\right)$$

$\gamma_{toe} = 808.76 \ kN/m^2$

$$\gamma_{heel} = \frac{\Sigma F_V}{B}\left(1 - \frac{6e}{B}\right) = \frac{34392}{69}\left(\frac{1 - 6(7.16)}{69}\right)$$

$\gamma_{heel} = 188.10 \ kN/m^2$

$\gamma_{heel} > 0$ Safe ok!

→ $\frac{\Sigma M_r}{\Sigma M_o} > 2$ (Factor of safety against overturning)

$$= \frac{2622163.8}{1681750.0}$$

$= 1.56 \not> 2$ Not safe

→ $\Sigma M_r > \Sigma M_o$

2622163.8 > 1681750.0 Safe ok!

→ $\frac{\mu \Sigma F_v + B \times q}{\Sigma F_H} > 1$ (Factor of safety against sliding)

$$\frac{0.75 \times 34392 * 69 \times 1400}{24500}$$

4.99 > 1 Safe ok!