[Sec→C]

[Straight Glacis fall] :-

Q1 Design an unflumed straight glacis fall (non-meter) for the Data

- Full supply Discharge = 40 cumec.

Full supply Level ⇒ U/S = 218.30 m

D/S = 216.80 m

Full supply Depth ⇒ U/S = 1.8 m

D/S = 1.8 m

Bed width ⇒ U/S = 26 m

D/S = 26 m

Bed Level ⇒ U/S = 216.50 m

D/S = 215.00 m

Drop ⇒ 1.5 m

Permissible exit gradient = 1/6.

Sol. ① [Design of crest] :-

Length of crest = Bed width

= 26 m

Discharge is given by :-

$Q = 1.84\, L\, H^{3/2}$ (unflumed)

$Q = 1.7\, L\, H^{3/2}$ (flumed)

$Q = 40, \quad L = 26$

$\therefore \quad 40 = 1.84\,(26)(H)^{3/2}$

$H = 0.89\,m$

Assuming Canal side slopes = 1:1

$$\text{Velocity} = Q/A = \frac{40}{(b+d)\cdot d}$$

$$= \frac{40}{(26+1.8)\,1.8} = \underline{0.8\ m/s}$$

$$\text{Vel. Head} = \frac{v^2}{2g}$$

$$= \frac{(0.8)^2}{2(9.81)} = \underline{0.03\ m}$$

∴ [U/S TEL = U/S FSL + vel. Head]

$$= 218.30 + 0.03$$

$$= \underline{218.33\ m}$$

$$\text{Crest level} = \text{U/S TEL} - H$$

$$= 218.33 - 0.89$$

$$= [\underline{217.44\ m}]$$

$$\text{width of crest} = \frac{2H}{3}$$

$$= \frac{2(0.89)}{3} = \underline{0.6\ m}$$

② [Design of cistern] :-

$$q = \frac{Q}{L_t} = \frac{40}{26} = 1.54\ \text{cumec/m.}$$

$H_L = 1.5\ m$ (always)

③

Hence from the Blench curves corresponding to the value of $q = 1.54$ & $H_L = 1.5$

we get $E_{f_2} = 1.44 m$

[R.L of cistern = d/s TEL − 1.25 E_{f_2}]

and d/s TEL = d/s FSL + vel. Head

= 216.80 + 0.03

= 216.83

R.L = 216.83 − 1.25 (1.44)

= 215.03 m

This is higher than d/s Bed level i.e 215 m

So, Keep R.L of cistern = 214.50 m

Length of cistern = $6 E_{f_2}$ (5 to 6 E_{f_2})

= 6 × 1.44

= 8.62 m

Depth of cistern = D/s Bed level − R.L of cistern

= 215 − 214.50

= 0.5 m

∴ Provide a cistern of 9 m Length

③ [Design of Impervious floor] :-

Min. Depth of U/S Curtain wall

$$= \frac{D1}{3} = \frac{1.8}{3} = \underline{0.6m}$$

Min. Depth of D/S Curtain wall

$$= \frac{D2}{2} = \frac{1.8}{2} = \underline{0.9m}$$

∴ Provide 0.4 m wide (fixed) & 1m deep Curtain wall at U/S & D/S.

Exit Gradient, $G_E = 1/6$

But $G_E = \frac{1}{\pi\sqrt{\lambda}} \frac{H_s}{d_2}$

H_s = Seepage head

= Crest level − d/s Bed level

= 217.44 − 215.00

= $\underline{2.44m}$

d_2 = Depth of D/S Curtain wall (1m)

$$\frac{1}{6} = \frac{1}{\pi\sqrt{\lambda}} \left(\frac{2.44}{1}\right)$$

$$\frac{1}{\pi\sqrt{\lambda}} = 0.068$$

from Khosla's exit gradient curve we get $\alpha = 40$ for $\frac{1}{\pi\sqrt{\lambda}} = 0.068$

or we get α through value of λ

$$\frac{1}{\pi\sqrt{\lambda}} = 0.068$$

so, $\lambda = 21.71$

and $\lambda = \frac{1+\sqrt{1+\alpha^2}}{2} = 21.71$

$\Rightarrow \boxed{\alpha = 42}$

$b = \alpha d_2$

$= 42(1) = \underline{42 m}$

But this length is too excessive so, increase the depth d_2 of the d/s curtain wall to 2m

$\Rightarrow \frac{1}{6} = \frac{1}{\pi\sqrt{\lambda}}\left(\frac{2.44}{2}\right)$

$\frac{1}{\pi\sqrt{\lambda}} = 0.137$, $\lambda = 5.43$

$\lambda = \frac{1+\sqrt{1+\alpha^2}}{2} = 5.43$

$[\alpha = 9.8]$

$b = \alpha d_2$

$b = 9.8(2) \Rightarrow \boxed{20 m}$

This length of 20m will be arranged

(i) length of cistern = $\underline{9 m}$

(ii) Length of D/S glacis :-

$d = 2(\text{crest level} - \text{D/S Bed})$

$= 2(217.44 - 215)$

$= \underline{5.88 m}$

(iii) Length of U/S glacis :-

$d = \frac{1}{2}(217.44 - \text{U/S Bed})$

$= \frac{1}{2}(217.44 - 216.50) = \underline{0.47 m}$

(iv) width of crest = 0.60 m

and extra length of 4.05 m will be provided as Balance.

Floor Thickness :-

(i) Provide a Min. thickness of 0.3 m at the u/s floor

(ii) Floor thickness at the Toe of glacis :-

Min. Static Head :-

= Pressure at Toe × Seepage head + [Depth of Cistern]

$= (0.51 \times 2.44) + 0.5$ (Pressure = 51% assumed)

= 1.75 m

Floor thickness required $= \frac{1.75}{2.24 - 1}$ (fixed)

= 1.42 m

Provide 1.5 m thick Floor at the Toe of d/s glacis.

④ [Design of D/s Protection] :-

(i) No Bed Protection will be needed

since the Deflector wall has been Provided.

(ii) <u>side Protection</u> :-

Length of side Protection = 3 D_2

= 3 x 1.8

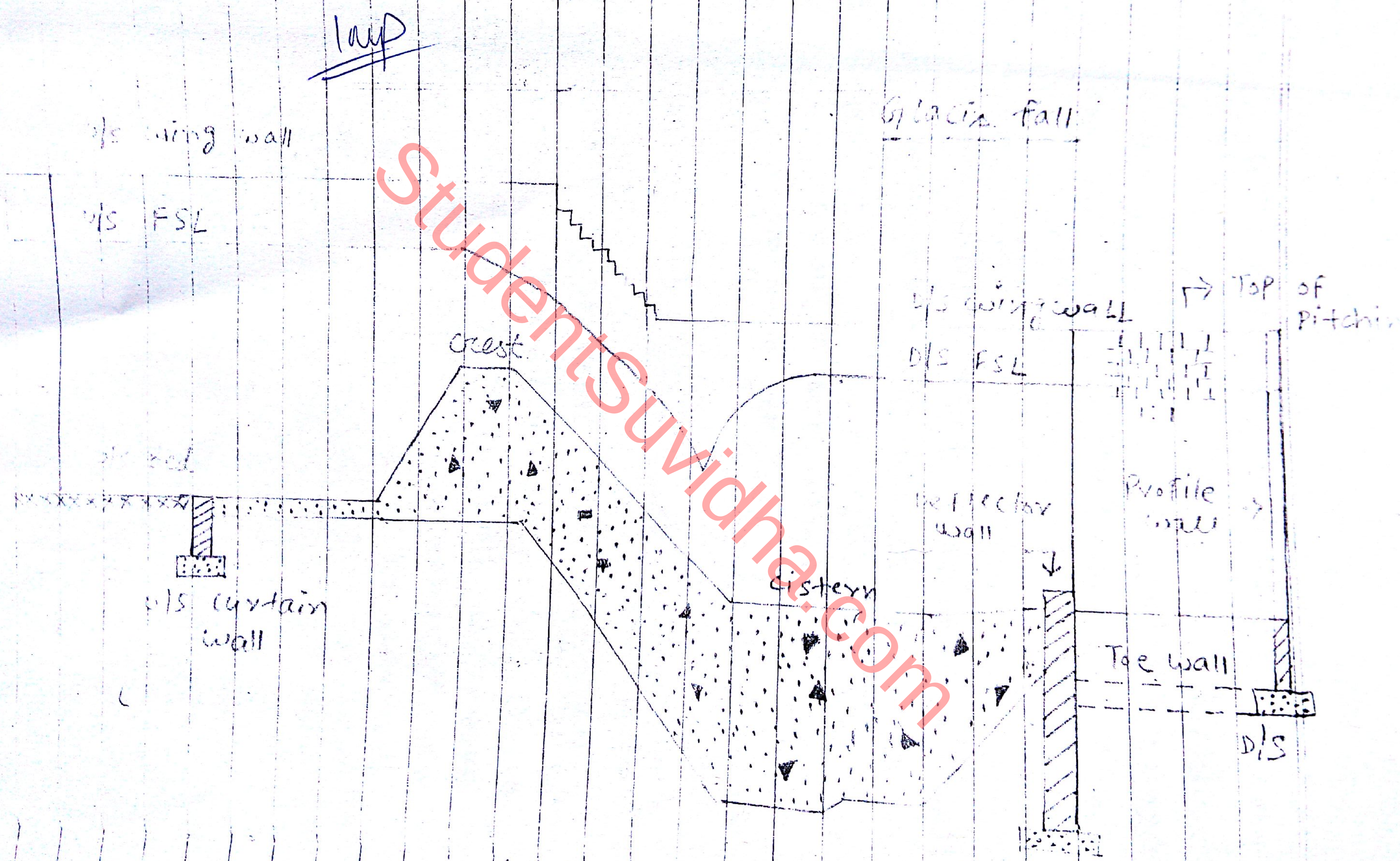
= 5.4m

Hence Provide 20 cm Brick pitching in 5.5 m length beyond the impervious floor at 1:1 Slope.

(iii) No Friction Blocks are Required since fluming has not been done.

⑤ [<u>Design of u/s approach</u>] :-

The u/s wing walls may be splayed at 45° from the u/s end of impervious floor and extended 1.0 m into the earthen banks from the line of F.S.L


Imp
Glacis fall
U/S wing wall
U/S FSL
Crest
D/S wing wall
D/S FSL
Top of Pitching
U/S curtain wall
Cistern
Deflector wall
Profile wall
Toe wall
D/S

Sol.