NAME	SHERAZ
ID	7862
SEC	B
SEM	6th

Qno # 01

Solution,

From Given data, The pressure drop Δp is expected to depend upon the gate opening h, the overall depth d, the velocity V, density ρ and viscosity μ.

List the relevant variable

Δp , h , d , V , ρ , μ

Dimensions

$\Delta p \rightarrow ML^{-1}T^{-2}$, $h \rightarrow L$, $d \rightarrow L$

$V \rightarrow LT^{-1}$, $\rho \rightarrow ML^{-3}$, $\mu \rightarrow ML^{-1}T^{-1}$

7862

As number of variables , $n = 6$

, $m = 3$ (M, L & T)

, $n - m = 3$

Choosing ($m = 3$) scaling variables.

$$\Pi_1 = \Delta p\, d^a V^b \rho^c$$

$$M^0 L^0 T^0 = [ML^{-1} T^{-2}] [L]^a [LT^{-1}]^b [ML^{-3}]^c$$

$$= M^{1+c} L^{-1+a+b-3c} T^{-2-b}$$

Now $\Pi_1 = \Delta p V^{-2} \rho^{-1} = \dfrac{\Delta p}{\rho V^2}$

$\Pi_2 = \dfrac{h}{d}$ (since h = length)

$\Pi_3 = \mu d^a V^b \rho^c$

1

$$M^0L^0T^0 = (ML^{-1}T^{-1})(L)^a(LT^{-1})^b(ML^{-3})^c$$

$$\Pi_3 = \mu d^{-1} V^{-1} \rho^{-1} = \frac{\mu}{\rho V d}$$

Recognition of the Reynolds number suggests that we replace Π_3 by

$$\Pi_3' = (\Pi_3)^{-1} = \frac{\rho V d}{\mu}$$

Hence, dimensional analysis yields

$$\Pi_3' = \left[\frac{\rho V d}{\mu}\right]_p = \left[\frac{\rho V d}{\mu}\right]_m$$

From the last we have a velocity ratio.

$$\frac{V_p}{V_m} = \frac{(\mu/\rho)_p \; d_m}{\mu/\rho_m \; d_p} = \frac{0.002/800}{1.0\times10^{-6}} \times \frac{1}{5}$$

$$= 0.5$$

Hence

$$V_M = \frac{V_p}{0.5} = \frac{3.0}{0.5} = 6.0\,ms^{-1}$$

(b) The ratio of the quantities of flow is.

$$\frac{Q_p}{Q_m} = \frac{(V\times a)_p}{(V\times a)_m} = \frac{V_p}{V_m}\left[\frac{d_p}{d_m}\right]^2$$

$$= 0.5\times5^2 = 12.5$$

(c) finally, for the pressure drop.

$$\Pi_1 = \left[\frac{\Delta p}{\rho V^2}\right]_p = \left[\frac{\Delta p}{\rho V^2}\right] \Rightarrow \frac{(\Delta p)_p}{(\Delta p)_m}$$

$$= \frac{\rho_p}{\rho_m}\left[\frac{V_p}{V_m}\right]^2 = \frac{800}{1000}\times0.5^2 = 0.2$$

Hence

$$\Delta p_p = 0.2 \times \Delta P_m$$
$$= 0.2 \times 60$$
$$= 12.0 \text{ kPa}$$

Qno # 2

Given data

Depth of water in the reservior = 78m

S.G of Dam material = 2.4 = G

Allowable Compressive Strength = 786 T/m^2

Height of wave = 1.2m

Solution

1) $H \text{ limiting} = \dfrac{6_{all}}{\gamma_w [G - (v + 1)}$

$= \dfrac{786 \times 1000}{1000 (2.4 - 0 + 1)}$

$H \text{ limiting} = 231.17$

2) Top width "av"

Free board $= 1.5 \times h \times \text{wave}$

$= 1.5 \times 1.2$

$= 1.8$

Height of dam = $H_D = H_w + F.B$

$= 78 + 1.8$

$$H_D = 79.8$$

$a = 14\%$ of H_D

$= 0.14 \times 79.8$

$$a = 11.172 m$$

③ Base width "b" (without offset)

for No sliding criteria

$$b' = \frac{H_w}{\mu G} = \frac{78}{0.7 \times 2.4}$$

$$b' = 46.45 \approx 47 m$$

7862

*) for no tension criteria

$$b' = \frac{H_w}{\sqrt{G}} = \frac{78}{\sqrt{2.4}}$$

$$\boxed{b' = 50.34}$$

4) Depth of Verticle portion on U/s side

$$h' = 2a\sqrt{G - G_0}$$

$$h' = 2 \times 11.172\sqrt{2.4 - 0}$$

$$h' = 34.60$$

$$\boxed{h' = 35}$$

5) Upstream offset

$$\frac{a}{16} = \frac{11.172}{16}$$

$$= 0.6$$

6) Depth below the water level to the end of inclined portion in

$$H/s = 3.14a\sqrt{G}$$

$$= 3.14(11.172)\sqrt{2.4}$$

$$\boxed{H/s = 54.33}$$

Total width of the base of the dam

$$b = b' + \frac{a}{16} = 50.34 + \frac{11.172}{16}$$

$$\boxed{b = 51.03}$$

$$\tan \alpha = \frac{b'}{H} = \frac{50.34}{78}$$

$$\alpha = \tan^{-1}(0.64)$$

$$\boxed{\alpha = 32.8^\circ}$$

Depth of V. portion on D/s [from WL on U/s Side]

$$\tan \alpha = \frac{a}{d'} = \frac{11.172}{d'}$$

$$\tan \alpha = 11.172/d_1$$

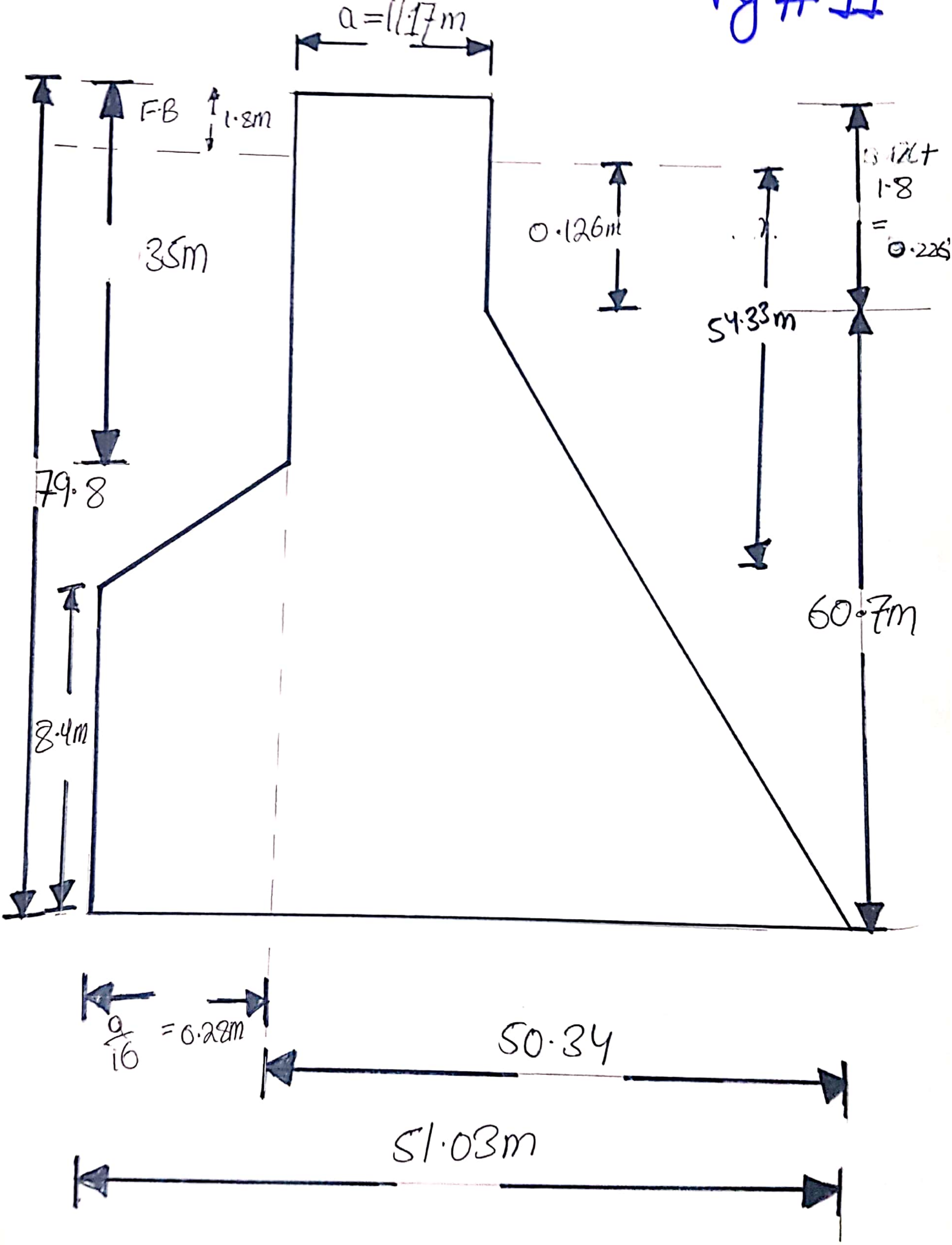
$$\boxed{d' = 0.126}$$

Depth of vertical portion

$$d = d' + FB = 0.126 + 1.8$$

$$\boxed{d = 0.2268m}$$

7862



a=11.17m
F.B
1.8m
35m
79.8
8.4m
0.126m
54.33m
0.126+
1.8
=
0.226
60.7m
a/16 =0.28m
50.34
51.03m

Qno #3

Model analysis & Similitude

The prototype that I will take for my analysis is "Dam". By means of Model analysis or Dimensional analysis. We take replica of prototype. On that Model we conclude tests so whenever we are Constructing actual "Dam" we will know the requirement for the considered Dam. Dimensional analysis is an research work due to which we gathered information.

By means of Similitude is similarities between model and prototype. There are three types of Similarities

1) Linear Similarity.
2) Kinematic ″ .
3) Dynamic ″ .

Linear Similarity

It is an ration b/w length of prototype and length of Model

Mathematically

$$\frac{L_P}{L_N} = L_\gamma = \frac{W_P}{W_M} = L_\gamma$$

7862

$$\frac{A_p}{A_m} = \frac{L_p \times b_p}{L_m \times b_m}$$

Kinematic Similarity

It is the ratio of velocity b/w prototype and model.

$$= \frac{V_{P_1}}{V_{m_1}} = V_r = \frac{V_{P_2}}{V_{m_2}}$$

kinematic Similarity depends on the flow except forces.

Dynamic Similarity

Dynamic Similarity is the ratio of force b/w prototype & model

7862

$$\frac{F_{ip}}{F_{im}} = F_{\gamma} = \frac{F_{vp}}{F_{vm}}$$

$$F_{\gamma} = \frac{F_{gp}}{F_{gm}}$$

7862

Qno #4

Ans : The downward velocity in a low dense fluid at equilibrium in which the Sum of the gravity force , buoyancy force and fluid drag force are equal to zero .

When a grain falls down in Still water it obtains a Constant velocity when the upward fluid drag force on the grain is equal to the downward Submerged weight of the grain . This is also called Setting velocity .

Fall velocity effected due to The following are the terms.

7862

a) Particle diameter

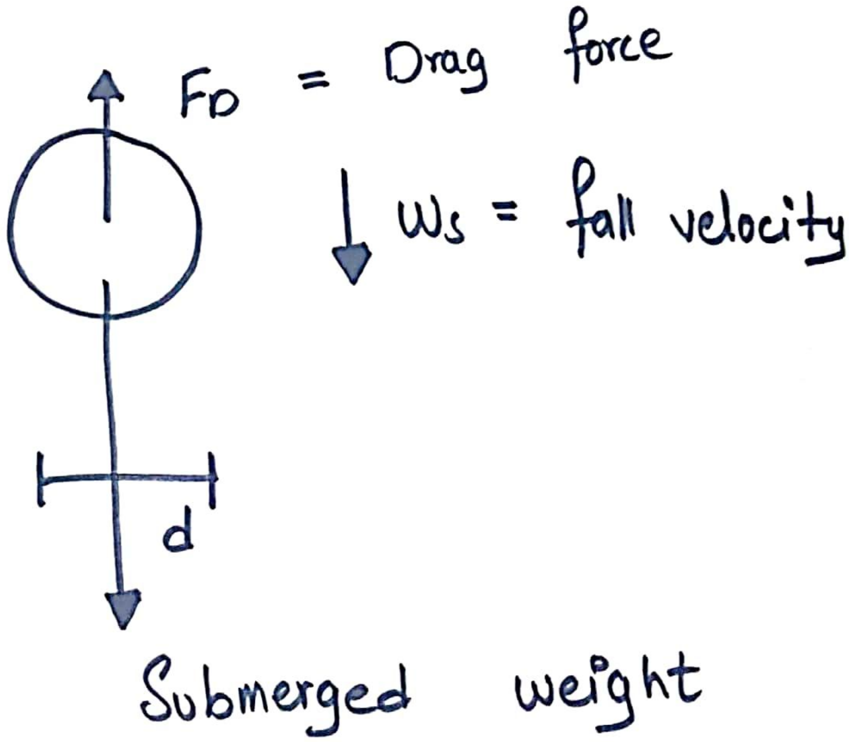
b) Particle density

c) Partical Concentration

d) Partical Shape

e) Viscosity of water [temperature]

f) Turbulance



7862

The force balance b/w the drag force and the Submerged weight gives.

F_D = Submerged weight

$$\frac{1}{2} \rho C_D \frac{\pi}{4} d^2 w_s^2 = (\rho_s - \rho) g \frac{\pi d^3}{6}$$

$A = \frac{\pi d^2}{4}$ = Projected Area

C_D = Drag Co-efficient

W_s = fall velocity of Sediment

$$= \sqrt{\frac{4gd}{3C_D} \left(\frac{\rho_s - \rho}{\rho}\right)}$$

ρ = Density of water

ρ_s = Density of Sediment particle

Particle Size (diameter)

Particle Size is a notion introduced for Comparing dimensions of Solid Particles, liquid particles or gaseous Particles.

Particle density

The particle density or true density of a particulate Solid or powder, is the density of the particles that make up the powder.

Particle Shape.

It defined by the relative dimensions of the long, intermediate and Short axes of the particles

Viscosity of water

Viscosity defines a fluid's internal resistance to flow and may be though of as a measore of fluid friction.

Turbolance

turbulance or turbulent flow is fluid motion characterized by Chaotic changes in pressure and flow velocity. It is an Contrast to laminar flow