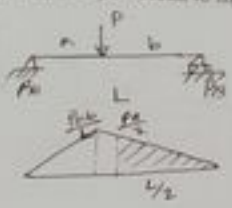
DWASA- 2021
Section A= 20 mcq
Section B= 10X5=50

1.Determine maximum deflection of the beam with moment area method EI constant. Length of beam L, p is point load on simply supported beam from the left support at (a) distance and (b) distance from the point load to the right support



$R_A = \frac{Pb}{L}$

$R_B = \frac{Pa}{L}$

2 A rectangular channel water is flowing per meter length as 4.5 m3/s/m. 6.5 wide channel at 6° angle with horizontal. The initial depth of flow is 0.55 m and the tail water depth is 4m. Determine the type of jump and draw the net sketch

$q = 4.5 m^3/s/m$

$b = 6.5 m$ (wide)

$\theta = 6°$

$d_1 = 0.55$

$h_2 = 4m$

$\frac{d_1}{h_1} = \cos\theta$

$\Rightarrow h_1 = 0.55/\cos 6°$

$= 0.553 m.$

$V = \frac{q}{d_1 b} = 1.25$

$Fr_1 = \frac{V}{\sqrt{g d_1}}$

$= \frac{1.25}{\sqrt{9.81 \times 0.55}}$

$= 0.538$

$h_2 = \frac{h_1}{2}\left(\sqrt{1+8Fr^2} - 1\right)$

$= \frac{0.553}{2}\left(\sqrt{1+8\times 0.538^2} - 1\right)$

$= 0.227 m < 4m$

$= h_2 < h_1$

Jump Sloping occurs on sloping

$h_2^* = \frac{h_1}{2}\left(\sqrt{1+8M^2} - 1\right)$

$M^2 = K_1^2 Fr_1^2 \quad K_1^6 = 10^{0.027 \times 6}$

$= (1.45)^2 \times 0.538) \quad = 1.45$

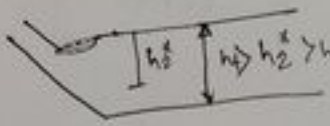
$= 0.61$

$h_2^* = \frac{0.553}{2}\left(\sqrt{1+8\times 0.61} - 1\right)$

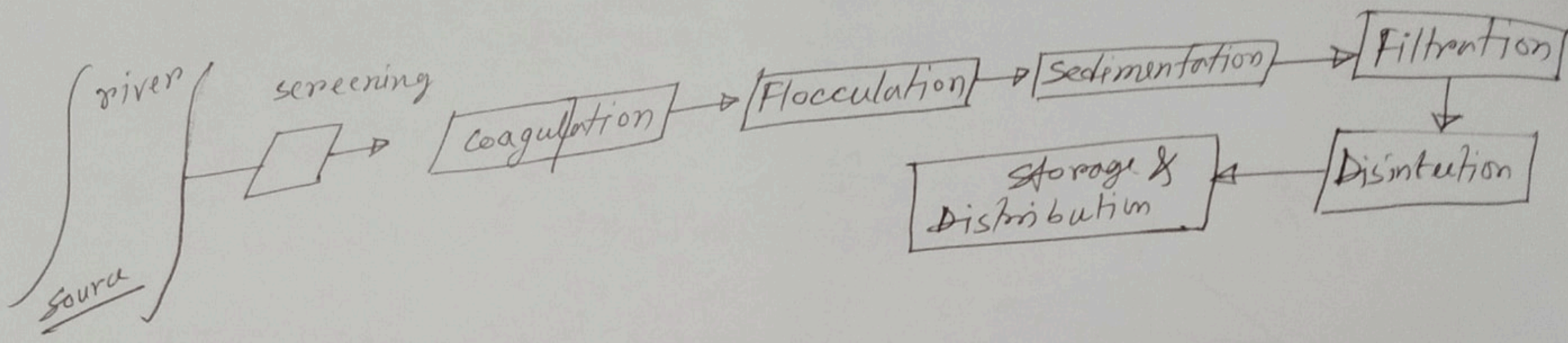
$= 0.394 m$

$h_1 > h_2^* > h_2$

D-type Jump



3. Draw the flow diagram of water treatment of a river water.



4. Define BOD and COD? The 5 day BOD of waste water is 200mg/L at 20°C with constant rate 0.21/d. Determine the 10 day BOD of waste water at 20°C.

$BOD_5 = 200\ mg/L$ at 20°c

$K = 0.21/d$

$BOD_{10} = ?$ at 20°c

$$BOD_5 = L(1 - e^{-Kt})$$

$$\Rightarrow 200 = L(1 - e^{-0.21 \times 5})$$

$$\Rightarrow L = 307.66\ mg/L$$

$$BOD_0 = L(1 - e^{-Kt})$$

$$= 307.66(1 - e^{-0.21 \times 10})$$

$$= 269.98\ mg/L$$ Ans:

5.Design a sewer pipe half full of water flow with 300 cfs . Longitudinal slope of this pipe 0.0025 and manning co efficient 0.015

$Q = 300\ ft^3/sec$

$S = 0.0025$

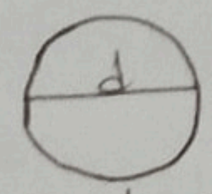
$n = 0.015$

$$Q = \frac{1.486}{n} A R^{2/3} S^{1/2}$$

$$\Rightarrow 300 = \frac{1.486}{0.015} * \frac{\pi d^2}{8} * \left(\frac{d}{4}\right)^{2/3} * (0.0025)^{1/2}$$

$$\Rightarrow d^{8/3} = 577.50$$

$$d = 10.85\ ft \quad \text{Ans:}$$

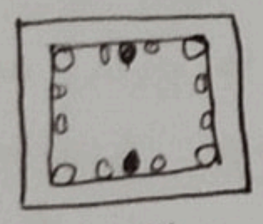


$$A = \frac{1}{2} * \frac{\pi}{4} d^2$$

$$P = \frac{\pi d}{2}$$

$$R = \frac{\frac{\pi d^2}{8}}{\frac{\pi d}{2}} = \frac{d^2}{8} \times \frac{2}{d} = d/4$$

6.A RCC column of size 20" x25" and 12 No 32mm longitudinal bar is used. Determine the axial load that will be concrete stress to 1500 psi. Given f'c = 4.5 ksi, fy= 60 ksi and n= 8



12 #32mm

$\sigma = 1500 psi$

$$\sigma = \frac{P_o}{25 A_o}$$

$= 3\ No$

$$A_{st} = 12 * \frac{\pi}{4}\left(\frac{32}{25.4}\right)^2$$

$= 14.96\ in^2$

$$P = \phi\alpha \{0.85 f'c (Ag - Ast) + fy\ Ast\}$$

$$= 0.80 \{0.85 * 4.5 (500 - 14.96) + 60 * 14.96\}$$

$= 2202.30\ Ksi$

$$A_t = Ag + Ast(8-1)$$

$= 500 + 14.96(8-1)$

$= 604.72$

$$\sigma = \frac{P_n}{A}$$

$$\Rightarrow P_n = 1500 * 604.72/1000$$

$= 907080/1000$

$= 907.1\ Kips$

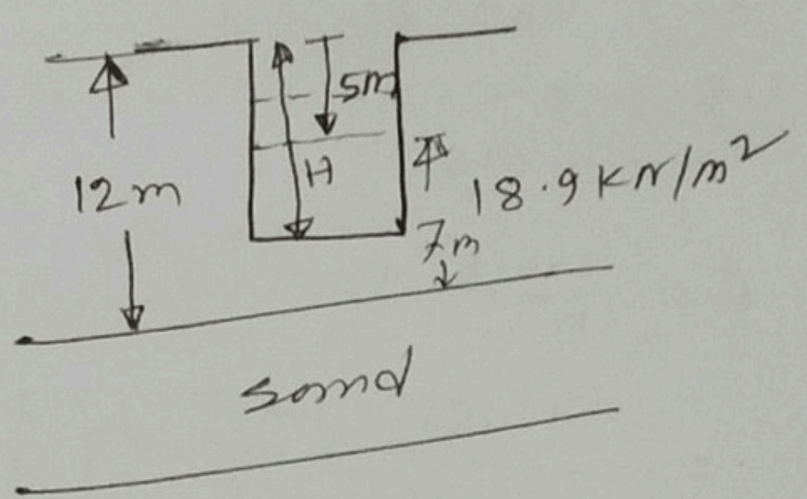
7.A 12m saturated clay layer underlined a sand layer. Water table is 5m below the ground surface. Determine the cut of clay layer. The saturated clay unit weight is 18.9 kn/m2

$$\sigma' = (12-H)\gamma - \gamma_w h_1 = 0$$

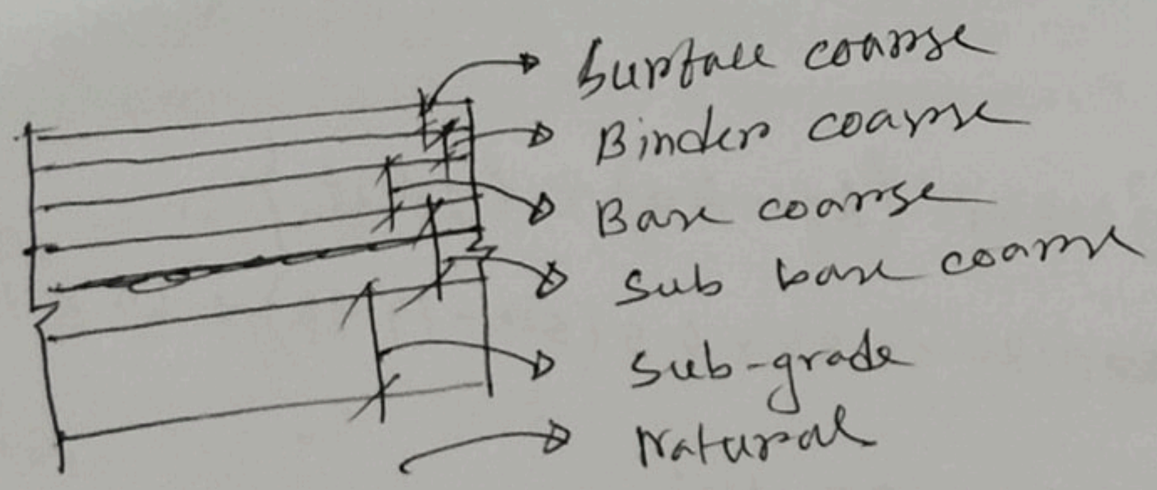
$$\Rightarrow (12-H)*18.9 - 9.81*7 = 0$$

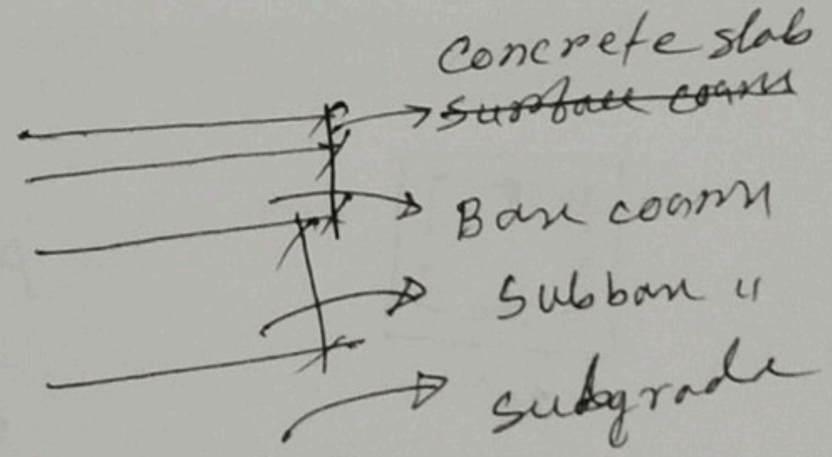
$$\Rightarrow H = 8.367m$$

Ans:



8.Draw the cross section of flexible pavement and rigid pavement.





9. Determine the volume of cement, sand and stone chips of 10 cft casting with proportion 1:1.5:3

volume = 10 cft

Dry, v = 10 × 1.5 = 15 cft

Ratio sumation = 1 + 1.5 + 3 = 5.5

Cement = $\frac{15}{5.5} \times 1 \times 0.8$ = 2.18 ≈ 3 Bag

Sand = $\frac{15}{5.5} \times 1.5$ = 4.09 cft

Stone = $\frac{15}{5.5} \times 3$ = 8.182 cft

10. Draw the A. Rating curve B. IDF curve.

Fig. A typical simple rating curve

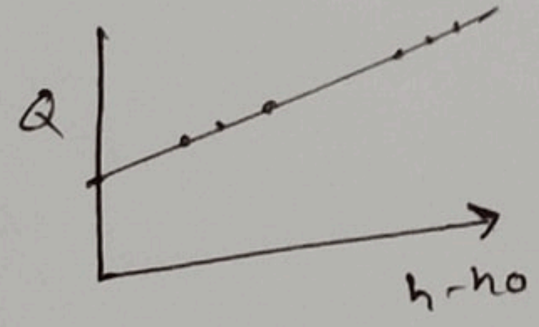
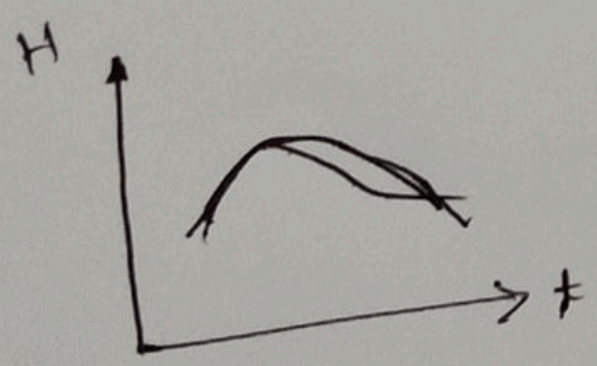


Fig: Logarithmic Scale rating curve



Stage Hydrograph

Fig: Discharge hydrograph

- x 9.81

IDF curve

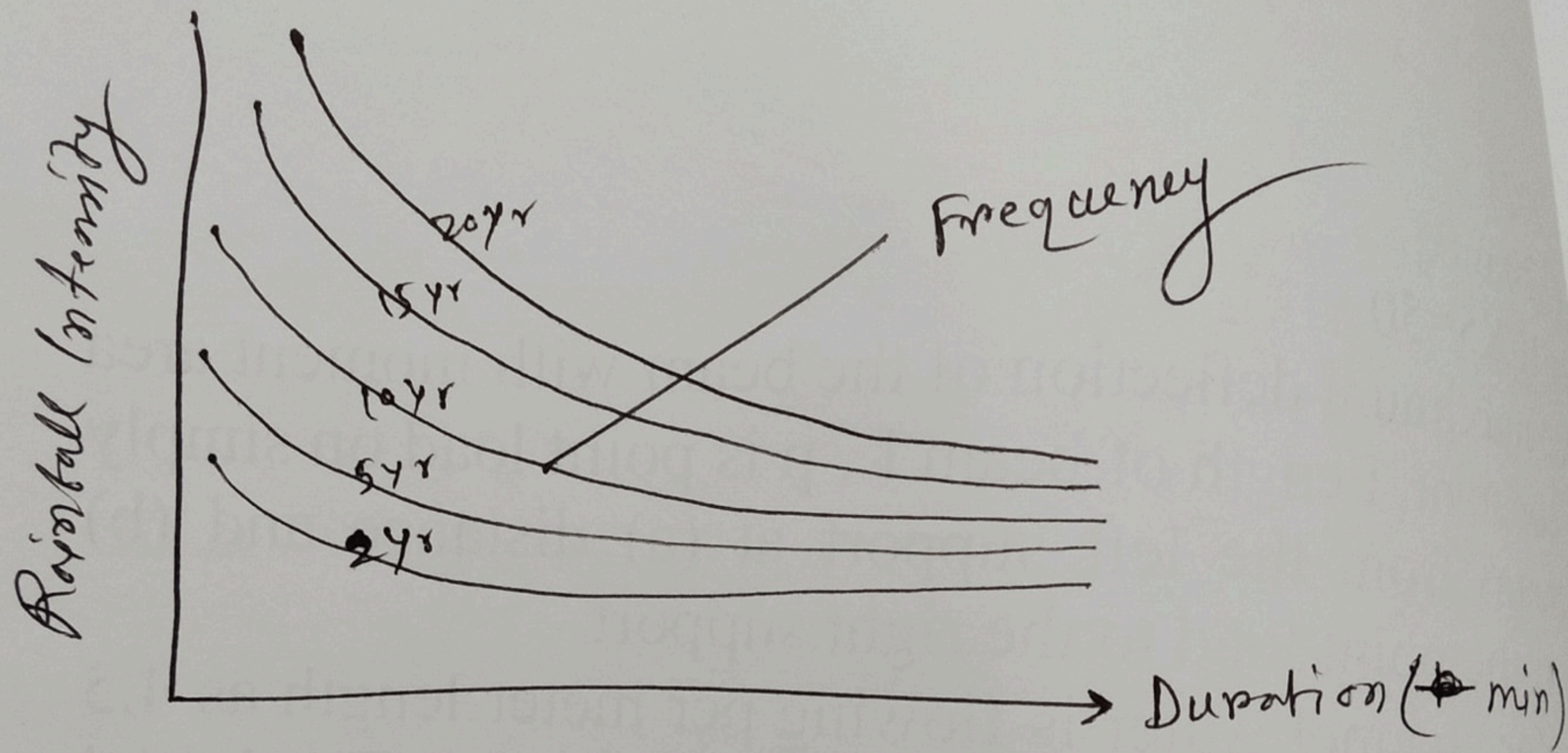


Fig : IDF Curve

Level D—D $\sigma = 16.77 \times 2.5 + 20.25 \times 3.5 = 112.8\ \text{kN/m}^2$

$u = 2.5 \times 9.81 = 24.53\ \text{kN/m}^2$, $\bar{\sigma} = 112.8 - 24.53 = \mathbf{88.27\ kN/m^2}$

Illustrative Example 10.6. *A 8 m thick layer of stiff saturated clay (γ = 19.0 kN/m^3) is underlain by a layer of sand. The sand is under an artesian pressure of 5 m. Calculate the maximum depth of the cut that can be made without causing a heave.*

Solution. Fig. E 10.6 shows the cut. Let H be the required depth of the cut. Heave will occur when the effective stress $\bar{\sigma}$ becomes zero at level A—A.

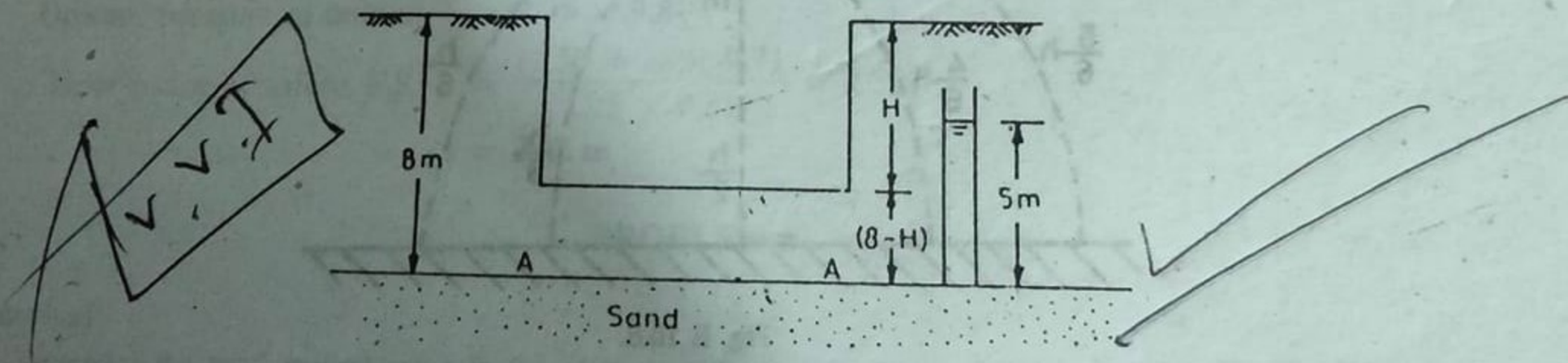


Fig. E 10.6.

$\sigma = 19.0 \times (8 - H) = 152.0 - 19H$, $u = 5 \times 9.81 = 49.05$

$\bar{\sigma} = 152.0 - 19H - 49.05 = 102.95 - 19H = 0$

or $H = \mathbf{5.42\ m.}$

Illustrative Example 10.7. *A 10 m thick layer of silty clay (ρ = 1864.64 kg/m^3) overlies a gravel layer. e gravel is under an artesian pressure of 12.5 m. It is proposed to excavate a foundation trench 2 m deep. termine the factor of safety against heaving.*

(b) What would be the factor of safety against heaving when a uniform pressure of 98.1 kN/m^2 is applied the footing constructed in the above trench ?

Solution. Factor of safety $= \dfrac{\text{Down–ward force at the top of gravel layer}}{\text{Upward force at the top of gravel layers}}$

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