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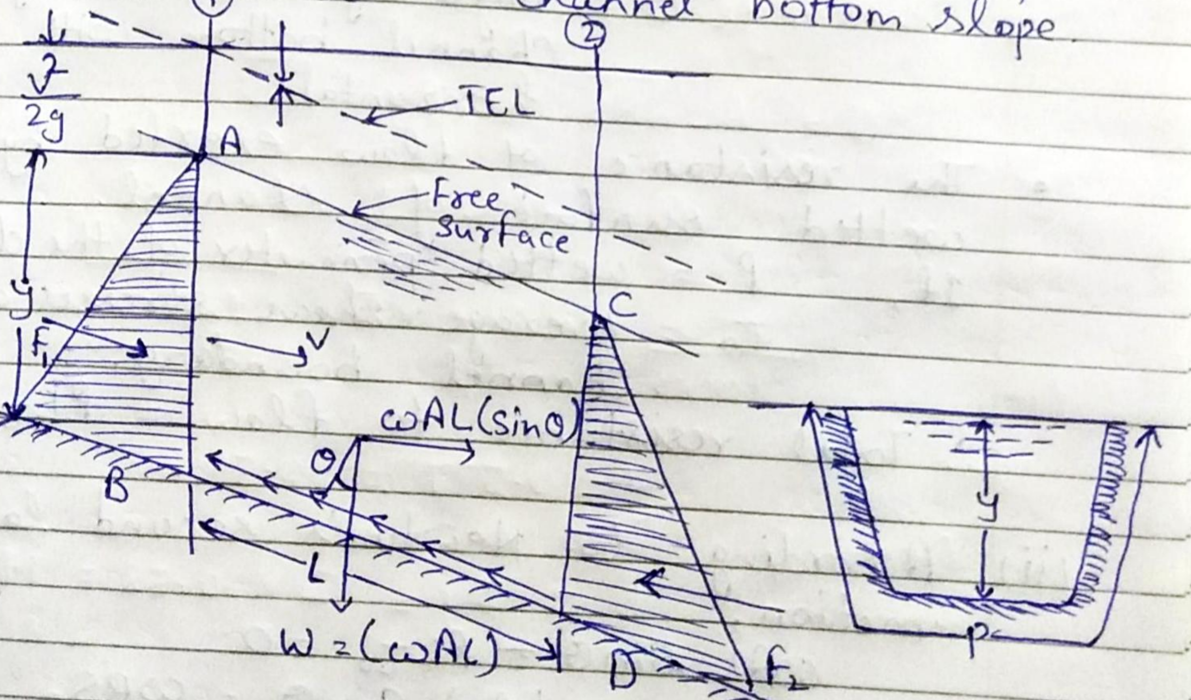
Ans-2 Channel of constant Velocity:
The main features of uniform flow with Constant velocity in an open channel are:

(i) The depth of flow, wetted area, velocity of flow and discharge are constant at every section along the channel.

(ii) The total energy line, water surface and channel bottom are all parallel to each other,

$$S_f = S_w = S_o = S$$

where, S_f = Energy line slope.
S_w = Water Surface slope.
S_o = Channel bottom slope.



Derivation

(i) Consider a small section of an open Channel. The forces acting on the free body of water ABCD in the direction of flow are as follows:

- Forces of hydrostatic water pressure F_1 and F_2 acting on the two ends of the free body.

  $F_1 = F_2$ ($\because$ Depth of water at section (1) & (2) are same)

- Component of weight of water in the direction of flow $= \omega AL \sin\theta$

  where, ω = Specific weight of water.

  A = wetted cross-sectional area of channel.

  θ = Angle of inclination of Channel bottom with horizontal.

- The resistance of flow exerted by wetted surface of channel.

  If, P = wetted perimeter of the channel.

  τ_0 = Average shear stresses at the channel boundary.

$\therefore$ Total resistance to flow $= PL\tau_0$

(ii) According to Newton's second law of motion,

$$\omega AL \sin\theta - PL\tau_0 = 0$$

$$\Rightarrow \tau_0 = \omega \left(\frac{A}{P}\right) \sin\theta = \omega R S_0 \quad \text{—— (1)}$$

where, $R = \frac{A}{P}$ = Hydraulic radius

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$S_0 = \sin\theta$ = Slope of channel bottom.

(iii) We know that

$$\tau_0 = \frac{f}{8}\rho v^2 \quad \text{——— (2)}$$

(iv) Equating the eq. (1) & (2) we get

$$wRS_0 = \frac{f}{8}\rho v^2 \Rightarrow v = \sqrt{\frac{8w}{\rho f}}\sqrt{RS_0} = \sqrt{\frac{8g}{f}}\sqrt{RS_0}$$

where, $g = w/\rho$

$$V = C\sqrt{RS_0} \quad \text{——— (3)}$$

(v) Discharge, $Q = AV = AC\sqrt{RS_0}$

where, $C = \sqrt{8g/f}$

Equation (3) is known as chezy's eq. for uniform velocity.