Q1 Specific Energy - Specific energy of flowing liquid is defined as energy per unit weight of the liquid with respect to the bottom of the channel.

Critical Flow Condition -

For a given discharge the condition for minimum specific force can be obtained by differentiating equation of specific force with respect to y and then considering it as $dF/dy = 0$

$$F = Q^2/gA + A\bar{z} \quad \text{— (1)}$$

Differentiate of Eq. (1) with respect

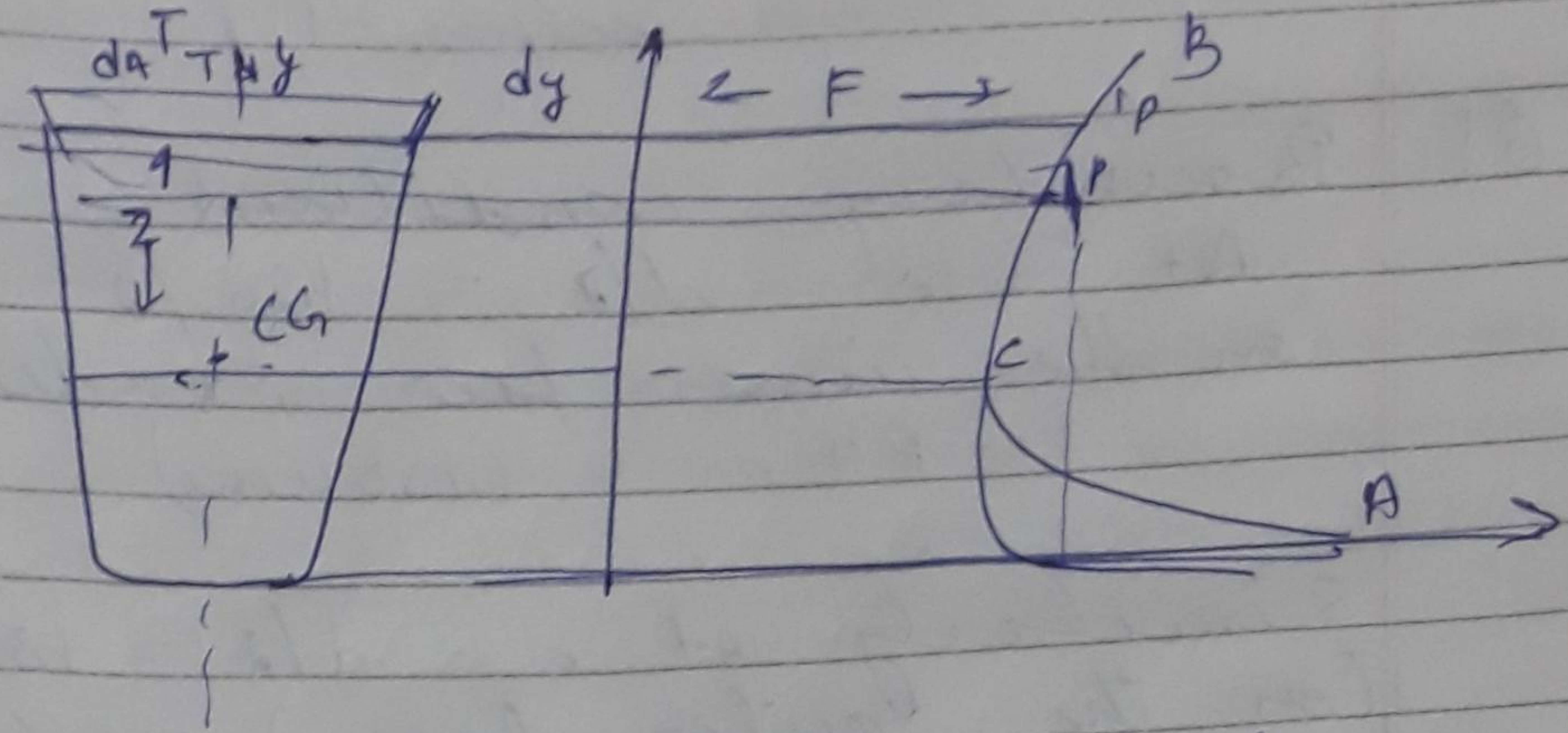
$$\frac{dF}{dy} = -\frac{Q^2}{gA^2}\frac{dA}{dy} + \frac{d(A\bar{z})}{dy} = 0 \quad \text{— (2)}$$

Since Q is constant & both A and $\bar{z}$ are the functions of y. ~~As shown~~ a change dy in the depth the corresponding change $d(A\bar{z})$ in the moment of the cross - sectional area about the free surface may by expressed as

$$\frac{d(A\bar{z})}{dy} = \left(A(\bar{z} + dy + T\,dy\,\frac{dy}{2}\right) - A\bar{z}$$

Neglecting smaller term $T\left(\frac{dy}{2}\right)^2$

$$d(A\bar{z}) = A\,dy$$



Substituting this value of $d(A\bar{z})$ in Eq ①

$$\frac{dE}{dy} = \frac{Q^2}{gA^2}\frac{dA}{dy} + \frac{A\,dy}{dy} = 0$$

Again since $(dA/dy) = T$

$$\frac{Q^2 T}{gA^3} = 1 \qquad \left[\because \frac{dA}{dy} = T\right]$$

The above condition is critical flow condition. Thus it can be said that at critical depth, specific force attains minimum value.

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