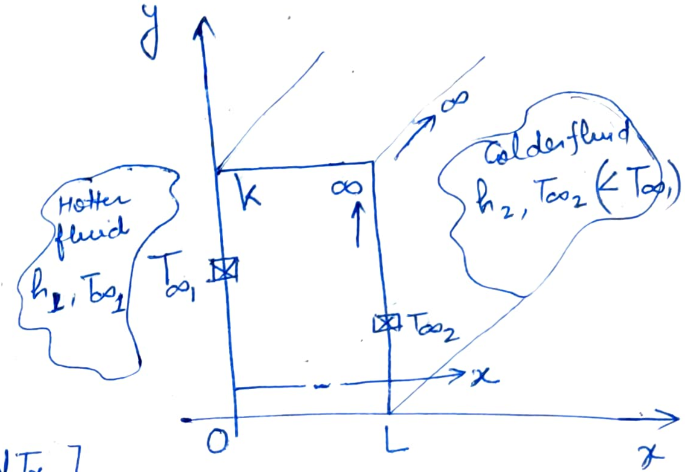
Que 2:- Steady 1-D heat conduction in an isotropic slab of const thermal conductivity without heat generation subjected to convection of BC's.



Governing equation:

$$\frac{d^2T}{dx^2} = 0 \quad \text{—— (I)}$$

$$T_{(x)} = Cx + D \quad \text{—— (II)}$$

BC's: 1

@ $x = 0$

$$h_1 \cancel{A}\left(T_{\infty_1} - T_{(x)}\right)_{x=0} = -k\cancel{A}\left[\frac{dT_x}{dx}\right]_{x=0}$$

$$h_1\left(T_{\infty_1} - (Cx + D)\right)_{x=0} = -k\,C$$

$$h_1\left(T_{\infty_1} - D\right) = -kC$$

$$kC - h_1 D = -h_1 T_{\infty_1} \quad \text{—— (III)}$$

BC's: 2

@ $x = L$

$$-k\cancel{A}\left(\frac{dT_x}{dT}\right)_{x=L} = h_2\cancel{A}\left(T_x - T_{\infty_2}\right)_{x=L}$$

$$-kC = h_2\left(Cx + D - T_{\infty_2}\right)_{x=L}$$

$$-kC = h_2 CL + h_2 D - h_2 T_{\infty_2}$$

$$C\left(k + h_2 L\right) + h_2 D = h_2 T_{\infty_2} \quad \text{—— (IV)}$$

by equation (III) & (IV)

$$kC - h_1 D = -h_1 T_{\infty_1} \quad \times h_2$$

$$(k + h_2 L)C + h_2 D = h_2 T_{\infty_2} \quad \times h_1$$

$$k h_2 C - \cancel{h_1 h_2 D} = -h_1 h_2 T_{\infty_1}$$

$$(k + h_2 L) h_1 C + \cancel{h_1 h_2 D} = h_1 h_2 T_{\infty_2}$$

$$C\left(h_1k+h_1h_2L+kh_2\right)=h_1h_2\left(T_{\infty_2}-T_{\infty_1}\right)$$

$$C=\frac{T_{\infty_2}-T_{\infty_1}}{\left(\frac{k}{h_1}+\frac{k}{h_2}+L\right)} \quad ; \quad D=T_{\infty_1}+\frac{k}{h_1}\times\frac{T_{\infty_2}-T_{\infty_1}}{\left(\frac{k}{h_1}+\frac{k}{h_2}+L\right)}$$

Put c & D in eq^n (1.1)

$$T_x=\frac{T_{\infty_2}-T_{\infty_1}}{\left(\frac{k}{h_1}+\frac{k}{h_2}+L\right)}x+T_{\infty_1}+\frac{k}{h_1}\frac{T_{\infty_2}-T_{\infty_1}}{\left(\frac{k}{h_1}+\frac{k}{h_2}+L\right)}$$

$$\frac{T_x-T_{\infty_1}}{T_{\infty_2}-T_{\infty_1}}=\frac{\left(x+\cancel{\frac{k}{h_1}}^{\,0}\right)}{\left(\cancel{\frac{k}{h_1}}^{\,0}+\cancel{\frac{k}{h_2}}^{\,0}+L\right)} \quad \text{———} \quad (V)$$

$$\boxed{\frac{T_x-T_{\infty_1}}{T_{\infty_2}-T_{\infty_1}}=\frac{x}{L}}$$

which is case with phase change H.T. like boiling or condensation it follows surface resistance offered heat resistance to zero.

∴ even mathematically equ^n (V) reduced to the solution with Dirichlet BC. This shows to validate the results.

$$q=-kA\left(\frac{dT_x}{dx}\right) \qquad \text{we know} \left(\frac{dT_x}{dx}=C\right)$$

$$q=-kAC$$

$$q=-kA\frac{\left(T_{\infty_2}-T_{\infty_1}\right)}{\left(\frac{k}{h_1}+\frac{k}{h_2}+L\right)}=\frac{-\left(T_{\infty_2}-T_{\infty_1}\right)}{\left(\cancel{\frac{1}{h_1A}}^{\,0}+\cancel{\frac{1}{h_2A}}^{\,0}+\frac{L}{kA}\right)}$$

$$\boxed{q=\frac{T_{\infty_1}-T_{\infty_2}}{L/kA}}$$

Thermocol & foam is a very good example of insulator in H.T. prevention.

⇒ cold storage plant.

⇒ Metallurgy laboratory.