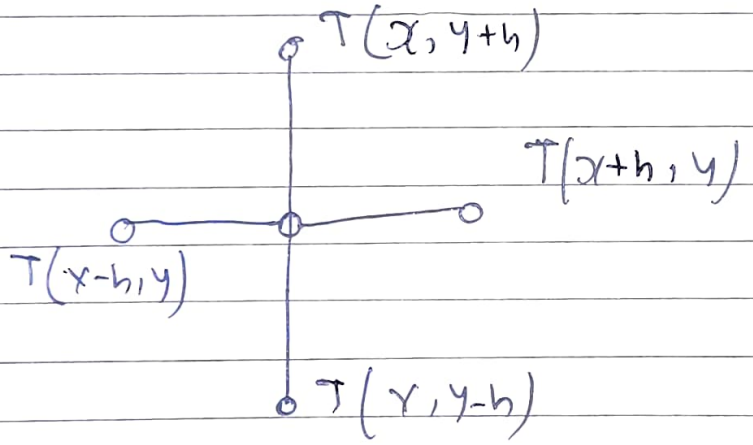
Assignment-3

* 2D Conduction heat Transfer:-

$$\frac{\partial T}{\partial x} = \frac{\partial}{\partial x}\left(q\frac{\partial T}{\partial x}\right) + \frac{\partial}{\partial T}\left(q\frac{\partial T}{\partial x}\right)$$

$$\frac{\partial T}{\partial x} = \frac{\Delta T}{\partial x} \Rightarrow \frac{T'(x,y) - T(x,y)}{\Delta t} = \frac{\partial T}{\partial t}$$



$$T(x+h) = T(x) + h\frac{\partial T}{\partial x} + \frac{h^2}{2}\frac{\partial^2 T}{\partial x^2}$$

$$T(x-h) = T(x) - h\frac{\partial T}{\partial x} + \frac{h^2}{2}\frac{\partial^2 T}{\partial x^2}$$

$$T(y+h) = T(y) + h\frac{\partial T}{\partial y} + \frac{h^2}{2}\frac{\partial^2 T}{\partial x^2}$$

$$T(y-h) = T(y) - h\frac{\partial T}{\partial y} + \frac{h^2}{2}\cdot\frac{\partial^2 T}{\partial y^2}$$

$$\therefore T(x+h, y) + T(x-h, y) = 4\left[T(x,y)\right]$$

$$+h^2\frac{\partial^2 T}{\partial x^2}$$

$$+h^2\frac{\partial^2 T}{\partial y^2}$$

$$+T(x+y+h)$$

$$+T(x,y-h)$$

$$\therefore \frac{\partial^2 T}{\partial x^2}+\frac{\partial^2 T}{\partial y^2} = \frac{T(x+h,y)+T(x-h,y)+T(x,y+h)+T(x,y-h)}{h^2}$$

$$\therefore \frac{T'(x,y)-T(x,y)}{\Delta t} = \frac{\alpha}{h^2}\left[T(x+h,y)+T(x-h,y)+T(x,y+h)+T(x,y-h)-4T(x,y)\right]$$

$$\therefore T'(x,y) = T(x,y)+\frac{\Delta t\,\alpha}{h^2}\left[T(x+h,y)+T(x-h,y)+T(x,y+h)+T(x,y-h)-4T(x,y)\right]$$