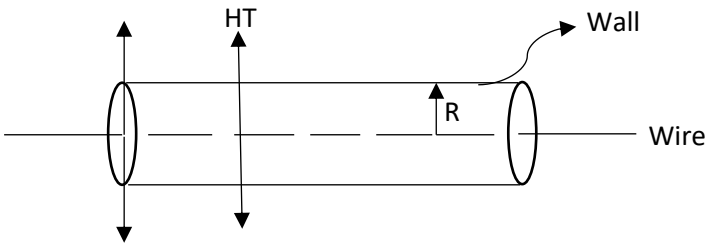
Tutorial – 1

1.



Temperature distribution in a cylindrical wire due to a uniform heat generation source (q^o/value) is given as –

$$(T - T_w) = \frac{q^o}{4K} (R^2 - r^2)$$

Here: - Tw = Wire temperature at surface

R = Radius of wire

K = Thermal conductivity of the material

A. Show that total heat generated by the source in the wire is the same as heat loss at the wire surface. (Assume no convective heat transfer)

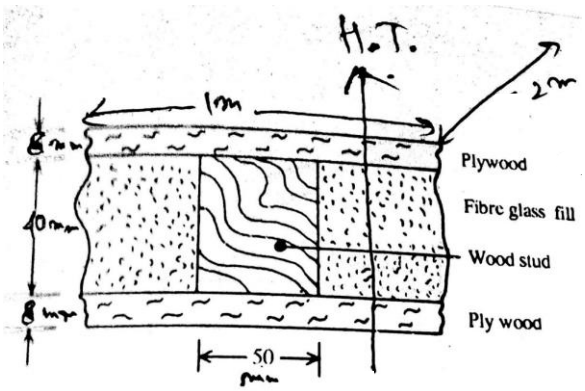
B. If the wire in the above problem carries current **I** and gives convective heat transfer **h** after being submerged in a water bath of temperature T_∞, find out the temperature at the centre of the wire.

Given: - l: length of wire

A: cross sectional area of wire

ƒ: specific resistivity

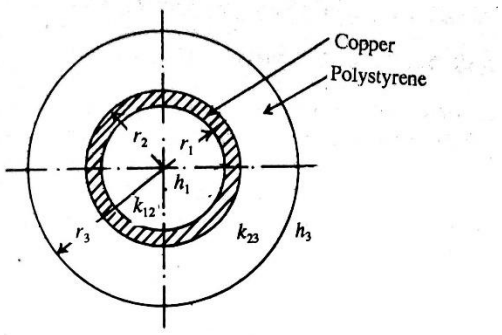
2. Consider a composite wall made up of two 8mm thick plywood sheets, 50mm hardwood studs running vertically with glass fibre fill as shown in the figure. What is the thermal resistance per metre run of a 2m high wall if heat transfer takes place by conduction across the wall?



3. A refrigerant at -40°C flows in a copper pipe of inside diameter 1cm and wall thickness 2mm. To reduce losses, a 4cm thick shell of 'thermocol' type of material (polystyrene) is put around the pipe. Calculate the heat leakage to the refrigerant

per metre length of pipe. Assume the internal and external heat transfer coefficients to be

a. Very high.
b. 500 and 5 W/m^2.K, respectively. The ambient air temperature is 40^{o}C.



Insulated tube