Unit -1/ Composite wall, Electrical analogy /Lesson plan No (LP-6/10)

In heat transfer, a composite wall is a system composed of multiple layers of different materials, each having its own thermal conductivity. Understanding how heat flows through such a wall is important for many engineering applications.

Composite Wall in Heat Transfer

- **Composite Wall:** A wall made up of multiple layers of different materials is called a composite wall. Each layer has its own thickness, thermal conductivity, and thermal resistance.
- **Thermal Resistance (R):** Each layer of the composite wall offers some resistance to heat flow. The thermal resistance for a layer can be calculated using the formula:

$$R = \frac{L}{kA}$$

Where:

- L = Thickness of the layer (m)
- k = Thermal conductivity of the material (W/m·K)
- A = Cross-sectional area perpendicular to heat flow (m^2)

Electrical Analogy

The concept of thermal resistance can be likened to electrical resistance in an electrical circuit. This analogy helps in understanding and calculating the total heat transfer through composite walls.

- **Heat Flow (Q):** Analogous to current (III) in an electrical circuit. It is driven by a temperature difference (analogous to voltage difference) across the wall.
- **Temperature Difference (ΔT\Delta TΔT):** Analogous to voltage difference (VVV) in an electrical circuit.
- **Thermal Resistance (R):** Analogous to electrical resistance (RRR) in an electrical circuit.
- **Ohm's Law (Electrical):**

$$V = IR$$

$$Q = \frac{\Delta T}{R}$$