

Experiment No: 5

Title : Verification of superposition theorem

Circuit Diagram :

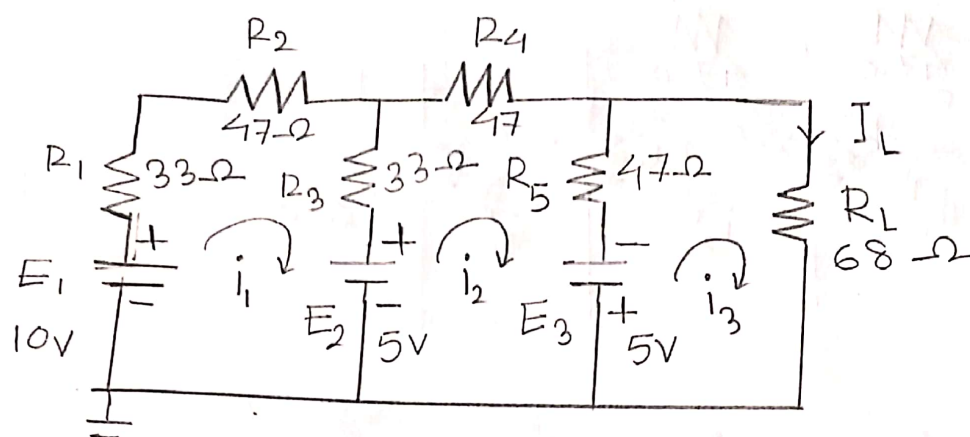


Figure 1. circuit with all sources active

$$I_L = i_3$$

Applying KVL at mesh 1,

$$(33 + 47 + 33)i_1 - 33i_2 - 0 = 10 - 5 \quad \text{--- (i)}$$

Applying KVL at mesh 2,

$$-33i_1 + (33 + 47 + 47)i_2 - 47i_3 = 5 + 5 \quad \text{--- (ii)}$$

Applying KVL at mesh 3,

$$0 - 47i_2 + (47 + 68)i_3 = -5 \quad \text{--- (iii)}$$

Solving equation (i) (ii) (iii)

$$I_{L_1} = i_3 = -4.264 \text{ mA}$$

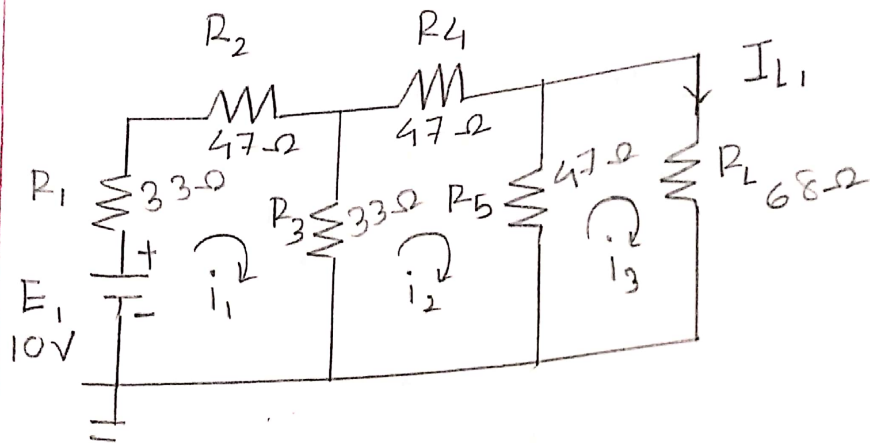


Figure 2: Circuit with E_1 source active

$$I_{L_1} = i_3$$

$$(33 + 47 + 33) i_1 - 33 i_2 - 0 = 10 \quad \text{---(i)}$$

$$-33 i_1 + (33 + 47 + 47) i_2 - 47 i_3 = 0 \quad \text{---(ii)}$$

$$0 - 47 i_2 + (47 + 68) i_3 = 0 \quad \text{---(iii)}$$

Solving equation (i) (ii) (iii)

$$i_3 = I_{L_1} = 12.16 \text{ mA}$$

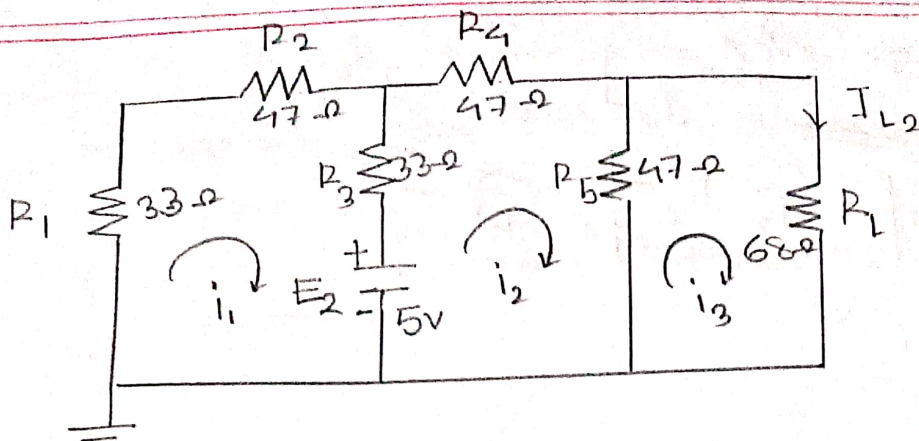


Figure 3: Circuit with E_2 source active

$$I_{L_2} = i_3$$

$$(33 + 47 + 33)i_1 - 33i_2 - 0 = -5 \quad \text{--- (I)}$$

$$-33i_1 + (33 + 47 + 47)i_2 - 47i_3 = 5 \quad \text{--- (II)}$$

$$0 - 47i_2 + (47 + 68)i_3 = 0 \quad \text{--- (III)}$$

Solving (I) (II) (III)

$$I_{L_2} = i_3 = 14.739 \text{ mA}$$

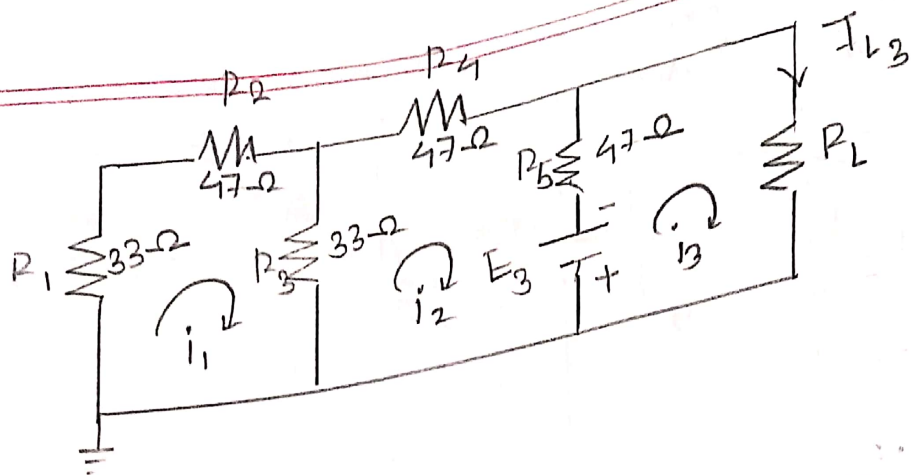


Figure 4: Circuit with E_3 sources active

$$I_{L3} = i_3$$

$$(33 + 47 + 33)i_1 - 33i_2 - 0 = 0 \quad \text{--- (i)}$$

$$-33i_1 + (33 + 47 + 47)i_2 - 47i_3 = 5 \quad \text{--- (ii)}$$

$$0 - 47i_2 + (47 + 68)i_3 = -5$$

Solving eq (i) (ii) (iii)

$$I_{L3} = i_3 = -31.168 \text{ mA}$$

Now, $I_{L1} + I_{L2} + I_{L3} = I_L$

$$\Rightarrow 12.16 + 14.739 - 31.168 = I_L$$

$$\Rightarrow -4.269 = I_L$$