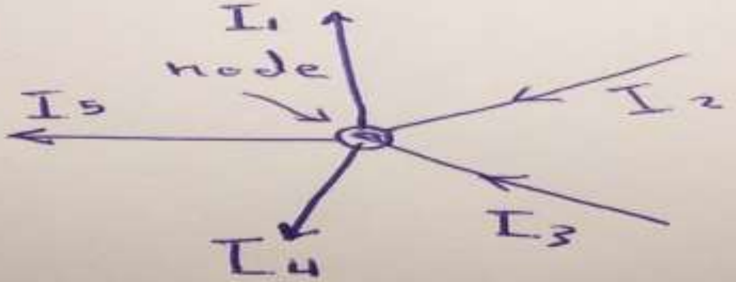
lec. 7

Kirchhoff's law

① Kirchhoff's first law - The current law (KCL) states that the total current or charge entering a junction or node exactly equal to the charge Leaving the node as it has no other place to go exept to no charge is Lost with in tho node. In onther words the algebraic sum of ALL the current enterning and leaving anode must be equal to Zero.

$$I_{exiting} + I_{enterning} = 0$$



$$I_1 + I_2 + I_3 - I_4 - I_5$$

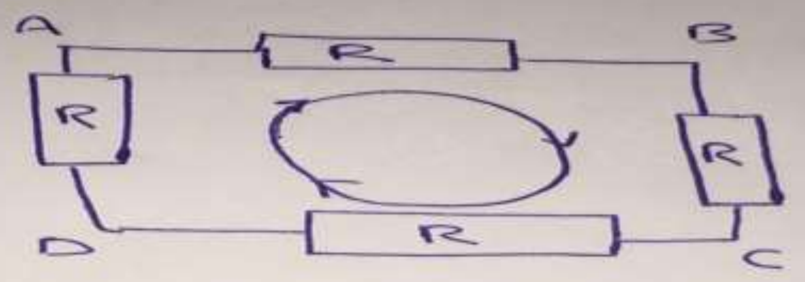
$$I_1 + I_2 + I_3 + (-I_4 + -I_5) = 0$$

$$I_1 + I_2 + I_3 = I_4 + I_5$$

② Kirchhoff's second law - (The voltage law) (KVL)

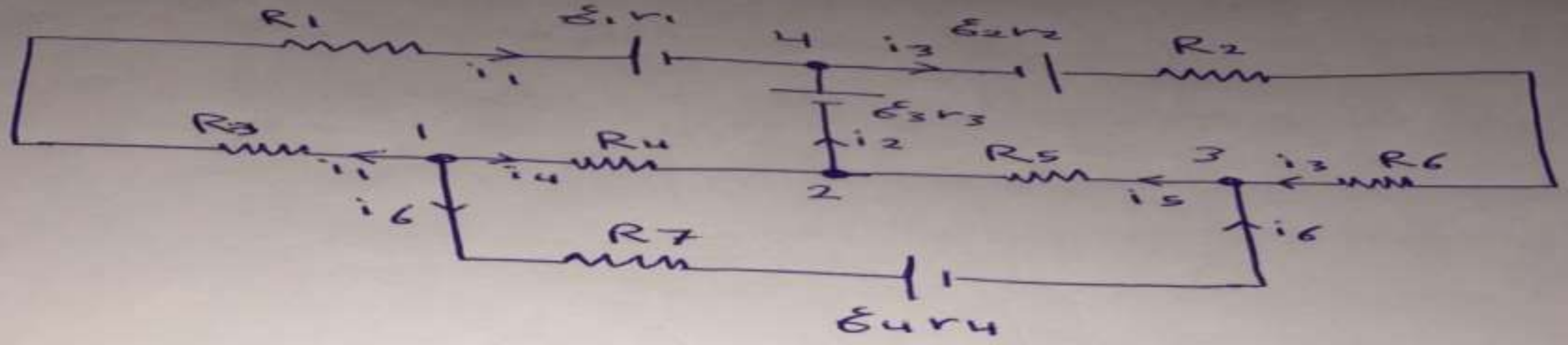
state in any Lood network, the total voltage around the loop is equal to the sum of all the same loop. which is also equal to Zero

The sum of all the voltage Drops around the loop equal to Zero



$$V_{AB} + V_{BC} + V_{CD} + V_{DA} = 0$$

To calculate Kirchhoff's first law from nodes (1, 2, 3, 4, 5)



① from node ① :

$$-i_1 - i_4 - i_6 = 0$$

② from node ② :

$$i_4 + i_5 - i_2 = 0$$

③ from node ③ :

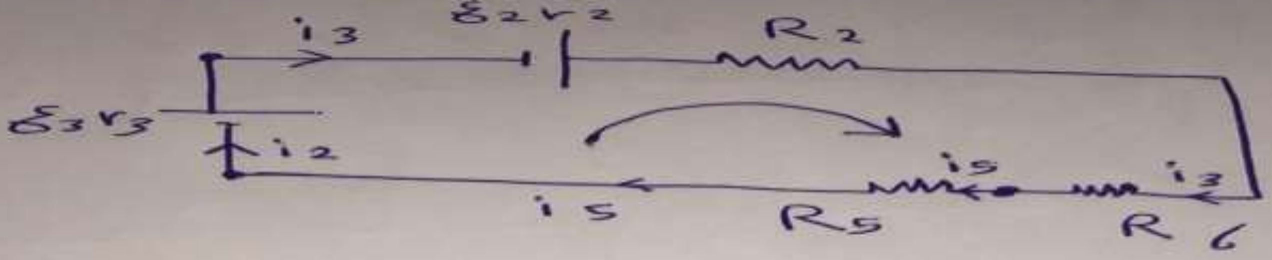
$$i_6 - i_5 + i_3 = 0$$

④ from node (4) :

$$i_1 + i_2 - i_3 = 0$$

To Calculate Kirchhoffs' second law from circuits

(1)

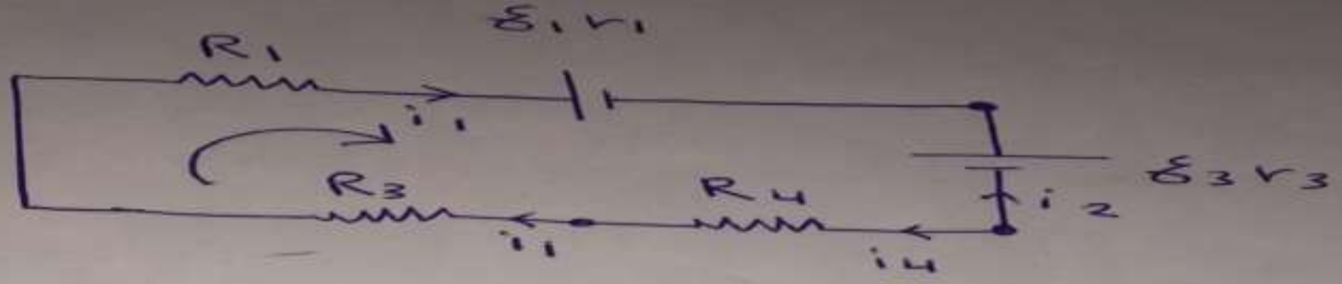


$$\sum \varepsilon = \sum Ri$$

$$\varepsilon_3 + \varepsilon_2 = i_5 R_5 + i_5 r_3 + i_3 r_3 + R_2 i_3 + R_6 i_3$$

$$\varepsilon_3 + \varepsilon_2 = i_5 R_5 + i_5 r_3 + \cancel{i_3 r_2} + i_3 (r_2 + R_2 + R_6)$$

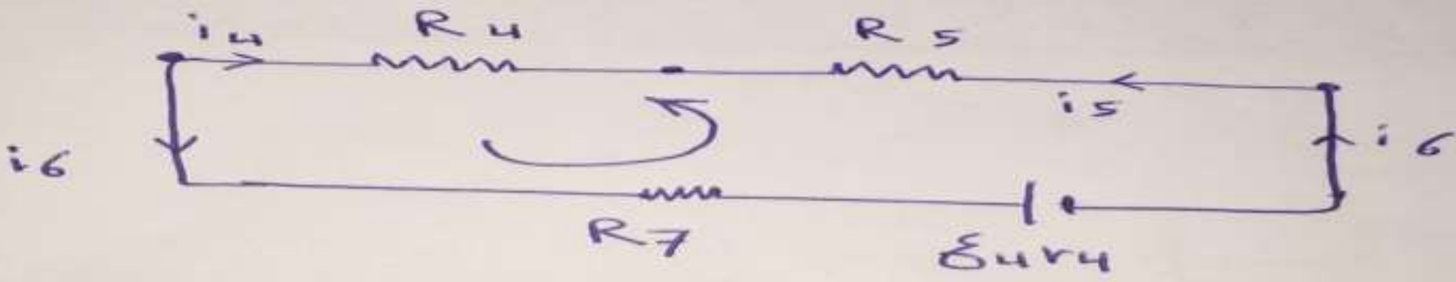
②



$$\sum \mathcal{E} = \sum Ri$$

$$-\mathcal{E}_1 - \mathcal{E}_3 = i_1(R_3 + R_1 + r_1) - i_2 r_3 - i_4 R_4$$

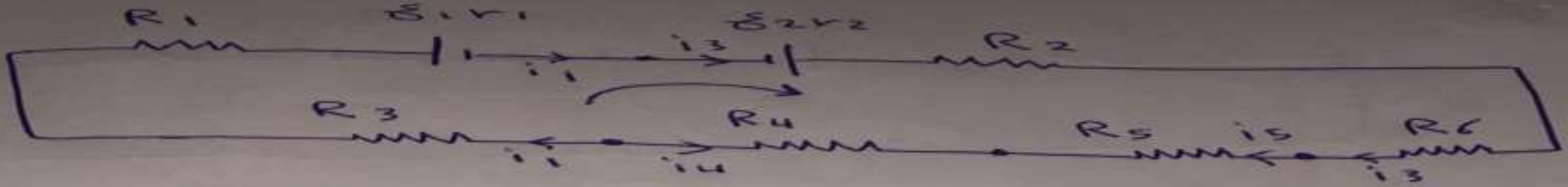
②



$$\sum \mathcal{E} = \sum Ri$$

$$-\mathcal{E}_4 = i_6(R_7 + r_4) + i_5 R_5 - i_4 R_4$$

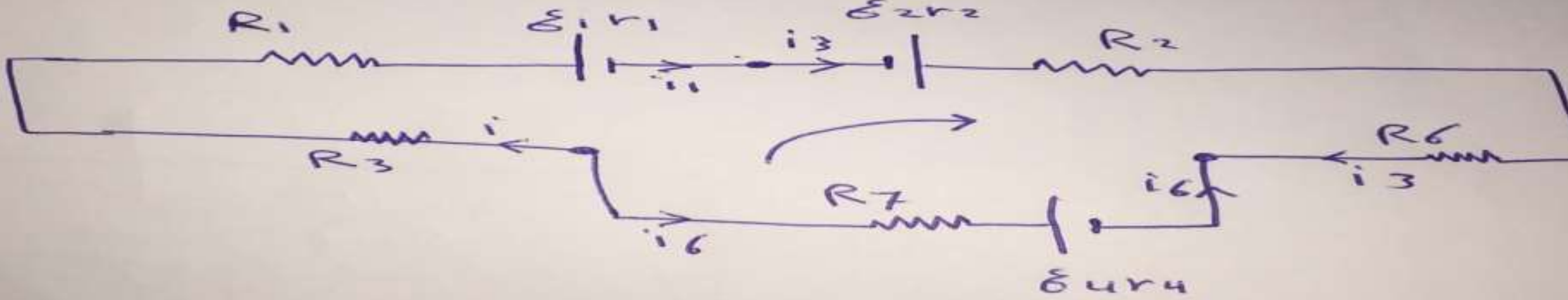
(4)



$$\sum \varepsilon = \sum iR$$

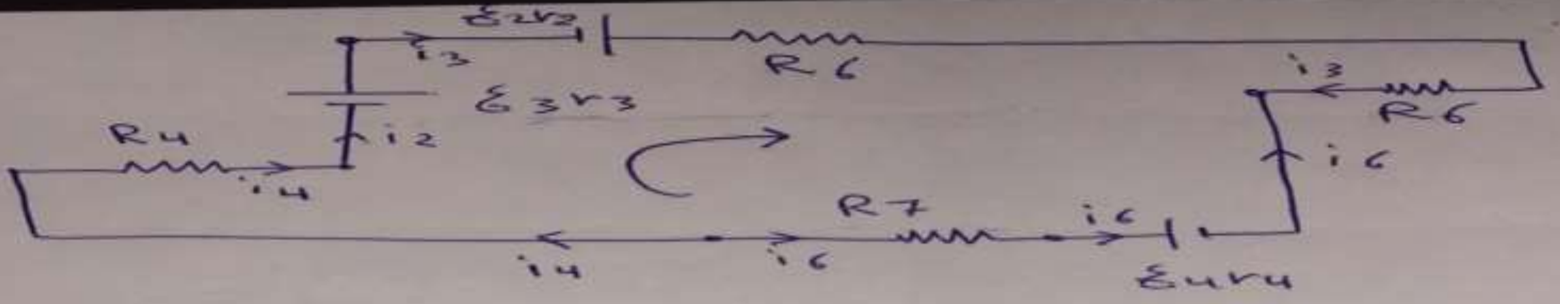
$$-\varepsilon_1 + \varepsilon_2 = i_1 (R_1 + r_1 + R_3) + i_3 (R_2 + R_6 + r_2) +$$
$$i_5 R_5 - i_4 R_4$$

(5)



$$-\varepsilon_1 + \varepsilon_2 + \varepsilon_4 = i_1 (R_3 + R_1 + r_1) + i_3 (r_2 + R_2 + R_6$$
$$i_6 (r_4 + R_7).$$

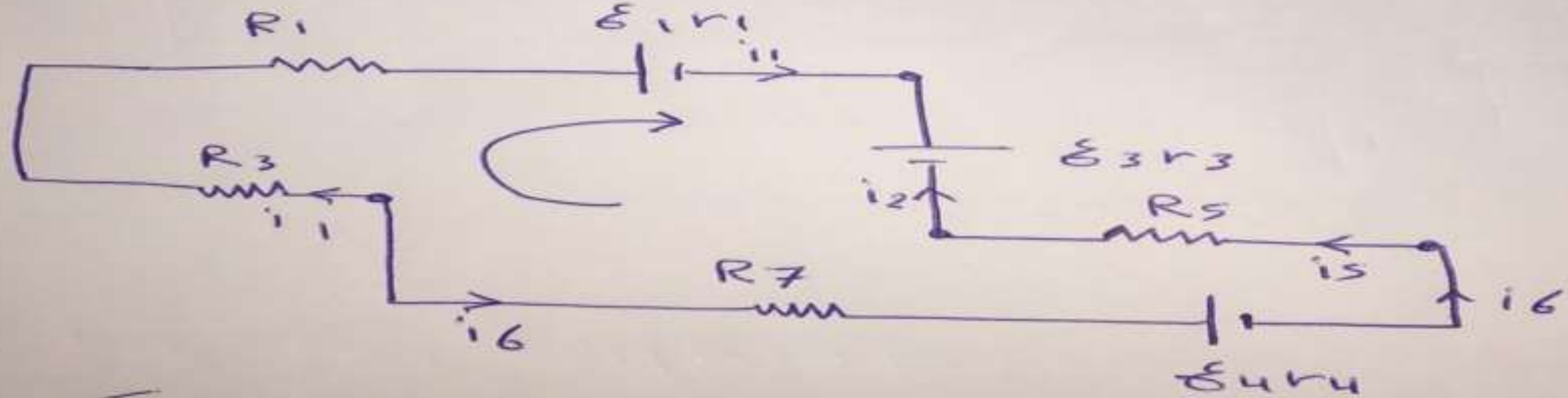
(6)



$$\sum \varepsilon = \sum iR$$

$$\varepsilon_2 - \varepsilon_4 + \varepsilon_3 = i_3(r_2 + R_2 + R_6) - i_6(r_4 + R_7) + i_4 R_4 + i_2 r_3$$

(7)



$$\sum \varepsilon = \sum iR$$

$$-\varepsilon_1 + \varepsilon_4 - \varepsilon_1 = i_1(R_3 + R_1 + r_1) - i_2 r_3 - i_5 R_5 - i_6(r_4 + R_7$$