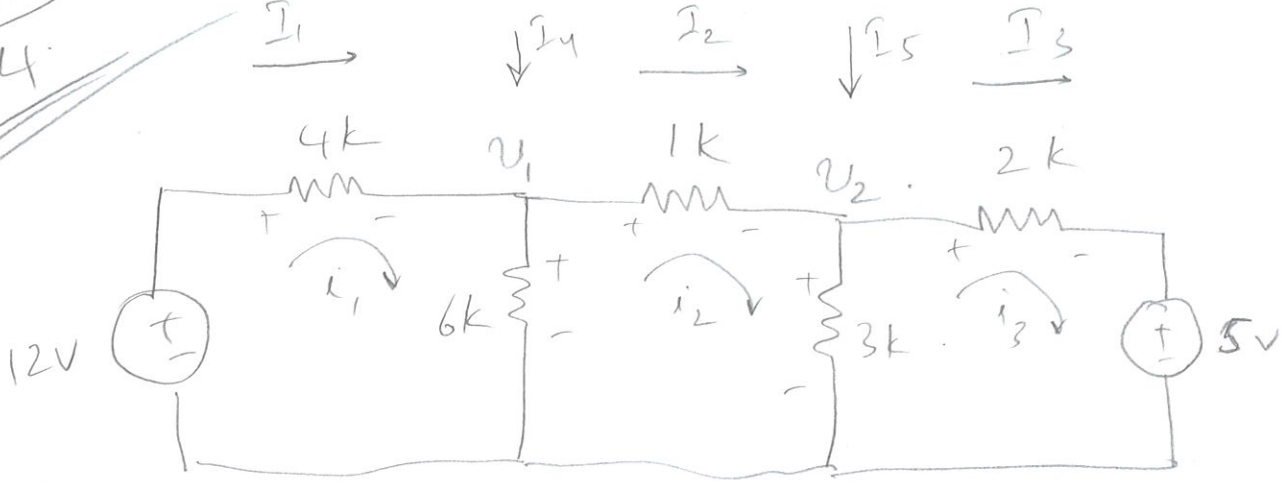
Circuit Lab 4




## Branch Currents

$I_1$, $I_4$, $I_2$, $I_5$, $I_3$

## Mesh Currents

$i_1, i_2, i_3$

$I_4 = i_1 - i_2$

$I_5 = i_2 - i_3$

$I_1 = i_1$

$I_2 = i_2$

$I_3 = i_3$

KCL at Node 1: $I_1 = I_2 + I_4$

KCL at Node 2: $I_2 = I_3 + I_5$

## Node Voltage Equations

(2)

$$\frac{V_1}{6000} + \frac{V_1 - 12}{4000} + \frac{V_1 - V_2}{1000} = 0$$

$$\frac{2V_1 + 3(V_1 - 12) + 12(V_1 - V_2)}{12000} = 0$$

or $2V_1 + 3V_1 - 36 + 12V_1 - 12V_2 = 0$

$$17V_1 - 12V_2 = 36 \quad \text{— (1)}$$

$$\frac{V_2}{3000} + \frac{V_2 - V_1}{1000} + \frac{V_2 - 5}{2000} = 0$$

$$\frac{2V_2 + 6V_2 - 6V_1 + 3V_2 - 15}{6000} = 0$$

$$-6V_1 + 11V_2 = 15 \quad \text{— (2)}$$

Approx

$V_1 = 5$ volts

$V_2 = 4$ volts

Solve these 2 simultaneous equations using Excel

## Mesh Current Equations

Mesh 1

$$-12 + 4000i_1 + 6(i_1 - i_2) = 0$$

$$4000i_1 + 6000i_1 - 6000i_2 = 12$$

$$10000i_1 - 6000i_2 = 12 \quad \text{GVO}$$

or $5i_1 - 3i_2 + 0i_3 = 6$ mA — (1)

Mesh 2

$$-6000(i_1 - i_2) + 1000i_2 + 3000(i_2 - i_3) = 0$$

$$-6000i_1 + 6000i_2 + 1000i_2 + 3000i_2 - 3000i_3 = 0$$

$$-6000i_1 + 10000i_2 - 3000i_3 = 0$$

$$6i_1 - 10i_2 + 3i_3 = 0 \quad \text{— (2)}$$

Mesh 3

$$-3000(i_2 - i_3) + 2000i_3 + 5 = 0$$

$$-3000i_2 + 3000i_3 + 2000i_3 = -5$$

$$-3000i_2 + 5000i_3 = -5$$

$$0i_1 - 3i_2 + 5i_3 = -5 \text{ mA} \quad \text{— (3)}$$

$i_1 = 1.25$ mA

$i_2 = 0.913$ mA

$i_3 = -0.652$ mA

Solve these 3 simultaneous equations using Excel