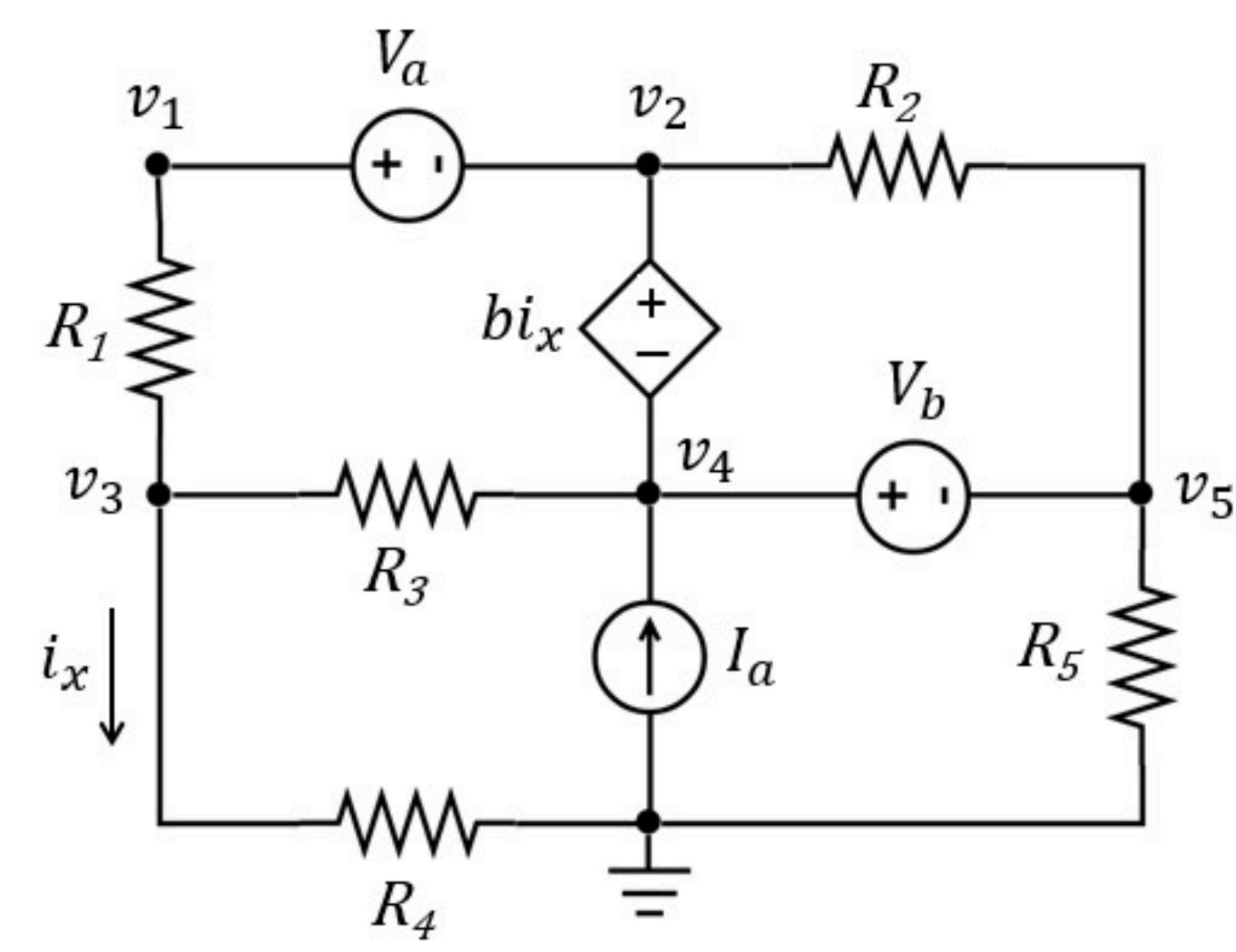


Nodal Mesh 005

Problem has been graded.



Given Variables:

- R1 : 1 ohm
- R2 : 2 ohm
- R3 : 1 ohm
- R4 : 2 ohm
- R5 : 1 ohm
- Va : 1 V
- Vb : 1 V
- Ia : 4 A
- b : 1.5 V/A

Calculate the following:

v1 (V) :

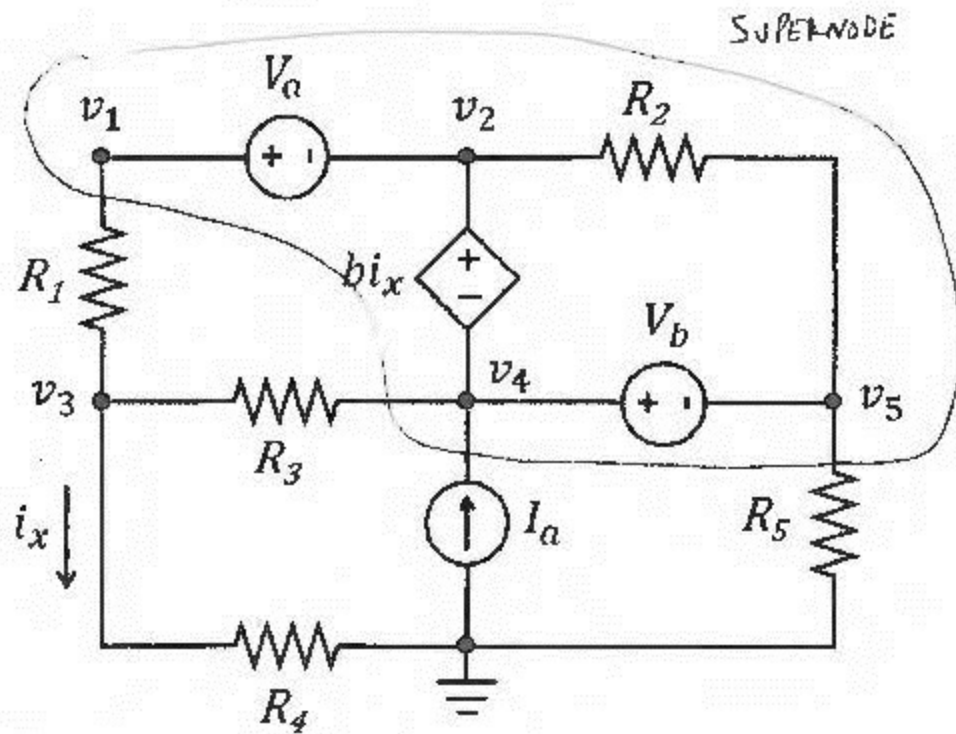
v2 (V) :

v3 (V) :

v4 (V) :

v5 (V) :

Hint: Use a supernode and move GND (and move it back).



$$R1 = 1 \Omega$$

$$R2 = 3 \Omega$$

$$R3 = 1 \Omega$$

$$R4 = 4 \Omega$$

$$R5 = 1 \Omega$$

$$V_a = -2 \text{ V}$$

$$V_b = 2 \text{ V}$$

$$I_a = 3 \text{ A}$$

$$b = 1 \text{ V/A}$$

$$\otimes \text{ KCL @ 3: } \frac{v_3 - v_1}{1} + \frac{v_3 - v_4}{1} + \frac{v_3}{3} = 0 \Rightarrow -3v_1 + 7v_3 - 3v_4 = 0 \quad (1)$$

$$\otimes \text{ KCL @ SN: } \frac{v_1 - v_3}{1} + \frac{v_4 - v_3}{1} + \frac{v_5}{1} - 3 = 0 \Rightarrow v_1 - 2v_3 + v_4 + v_5 = 3 \quad (2)$$

$$\otimes \text{ SN } V_a: v_1 = v_2 - 2 \Rightarrow v_1 = v_2 - 2 \quad (3)$$

$$\otimes \text{ SN } V_b: v_4 = v_5 + 2 \Rightarrow v_5 = v_4 - 2 \quad (4)$$

$$\otimes \text{ SN } bix: v_2 = v_4 + 1 \cdot \frac{v_3}{3} \Rightarrow v_3 = 3v_2 - 3v_4 \quad (5)$$

$$(4), (3) \text{ in } (1): -3v_2 + 6 + 21v_2 - 21v_4 - 3v_4 = 0 \Rightarrow 18v_2 - 24v_4 = -6$$

$$\Rightarrow 3v_2 - 4v_4 = -1 \quad (6)$$

$$(3), (4), (5) \text{ in } (2): v_2 - 2 - 6v_2 + 6v_4 + v_4 + v_4 - 2 = 3 \Rightarrow -5v_2 + 8v_4 = 7 \quad (7)$$

$$(6) \times 2 + (7): 6v_2 - 5v_2 = -2 + 7 \Rightarrow \boxed{v_2 = 5 \text{ V}}$$

$$\boxed{v_1 = 3 \text{ V}} \quad \text{FROM (3)}$$

$$\boxed{v_4 = 4 \text{ V}} \quad \text{FROM (6)}$$

$$\boxed{v_5 = 2 \text{ V}} \quad \text{FROM (4)}$$

$$\boxed{v_3 = 3 \text{ V}} \quad \text{FROM (5)}$$

CHECK KCL