

EECE 2150 - Electrical Engineering Fall 2023

Quiz 3

Prof. Charles A. DiMarzio

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Student Name: _____

The figure shows a circuit with some sources and resistors, with letters for potential nodes. In this circuit, $V_S = 10\text{ V}$, $i_s = 10\text{ mA}$, $R_1 = 1\text{ k}\Omega$, $R_2 = 5\text{ k}\Omega$, $R_3 = 1\text{ k}\Omega$, and $R_4 = 2500\text{ }\Omega$.

1. Which of the letters label the same node?

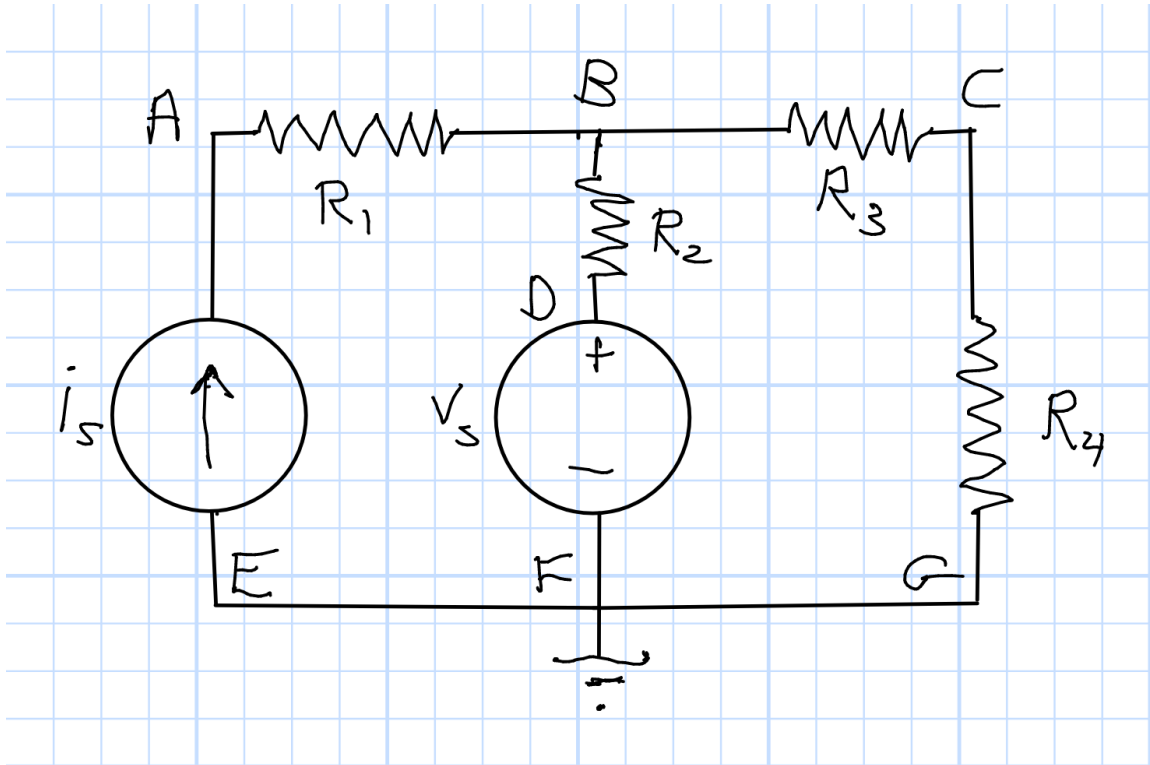
2. Which letter(s) label essential node(s)?

3. Write the node equation(s) symbolically.

4. Solve the equations numerically.

5. What are these voltages?

$V_B =$ _____ , $V_C =$ _____ , $V_A =$ _____ .



Solution

1. Which of the letters label the same node?

E, F, G

2. Which letter(s) label essential node(s)?

B

3. Write the node equation(s) symbolically with the unknown(s) on the left.

$$\frac{v_s - V_B}{R_2} + i_s + \frac{0 - V_B}{R_3 + R_4} = 0$$
$$\left(\frac{1}{R_2} + \frac{1}{R_3 + R_4} \right) v_B = \frac{V_s}{R_2} + i_s$$

4. Solve the equations numerically.

$$\left(\frac{1}{5000 \Omega} + \frac{1}{3500 \Omega} \right) v_B = \frac{10 \text{ V}}{5000 \Omega} + 0.01 \text{ A}$$
$$0.00048 \Omega^{-1} v_B = 0.001 \text{ A} + 0.01 \text{ A}$$
$$v_B = 24.6 \text{ V}.$$

5. What are these voltages?

$$V_B = 24.6 \text{ V}.$$

$$V_C = v_B \frac{R_4}{R_3 + R_4} = 17.6 \text{ V},$$

$$V_A = V_B + i_s R_1 = 34.6 \text{ V} \text{ (Yes, it is true that } v_A v_s \text{).}$$