ENGR 065 Electric Circuits

Lecture: Midterm Review

Today's Topics

- Review the Midterm concepts taught thus far
  - **Major Topics**
    - Variables:
    - Three Laws:
    - Circuit Analysis Techniques:
    - Basic Equations:
    - Basic Concepts:
- Go through sample problems as class exercise

Midterm Review

Variables:
- Voltage
- Current
- Resistance
- Power
- Energy

Three Laws:
- Ohm's Law
- Kirchhoff's Current Law (KCL)
- Kirchhoff's Voltage Law (KVL)

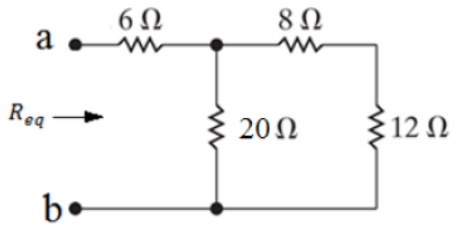
Circuit Analysis Techniques:
- KCL and KVL
- Resistance combinations
- Node-voltage and mesh-current
- Source transformations
- Thévenin and Norton Theorem

Basic Equations and Concepts:
- Power and energy in resistors
- Passive sign convention
- Ideal circuit elements: passive/active
- Ideal independent sources: volt/current
- Dependent sources: (careful w/ units)
  - Voltage controlled (volt/current)
  - Current controlled (volt/current)
- Divider circuits:
  - Voltage/current
- Open circuits:
  - $R = \infty$, no loads, switch (off state)
- Short circuits:
  - $R = 0$ $(V = 0)$, wires, switch (on state)
- Maximum power transfer
- Equivalent circuits
  - Series/parallel resistors
  - Series/parallel volt/current sources
  - Source transformations
  - Thévenin/Norton
- Superposition principle

Sample Questions

1) The equivalent resistance seen by the terminals **a** and **b** is

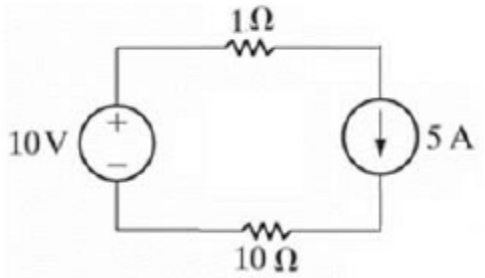
A. 4 Ω
B. 6 Ω
C. 8 Ω
D. 16 Ω



Sample Questions

2) The power associated with 10 Ω resistor is

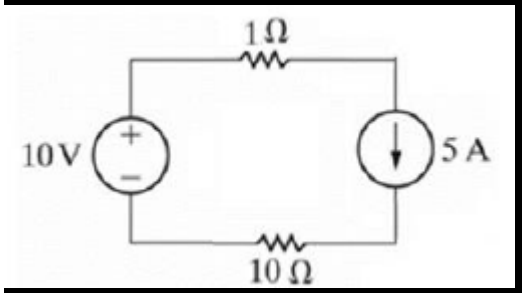
A. 25 W
B. - 25 W
C. 250 W
D. - 250 W



Sample Questions

3) The power associated with 10 V voltage source is

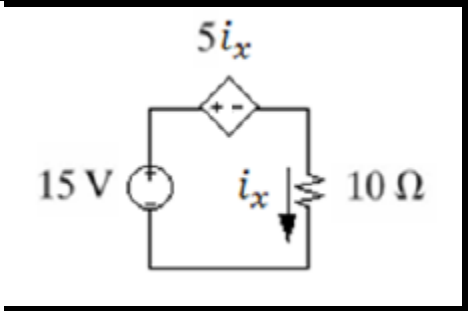
A. 50 W
B. - 50 W
C. 25 W
D. - 25 W



Sample Questions

4) The current i_x is

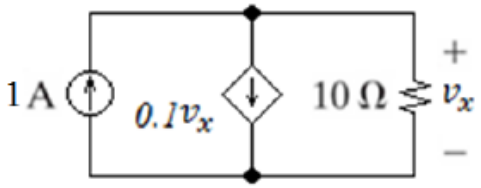
A. 1 A
B. - 1 A
C. 3 A
D. -3 A



Sample Questions

5) The voltage v_x is

A. 5 V
B. 10 V
C. 15 V
D. 20 V



Sample Questions

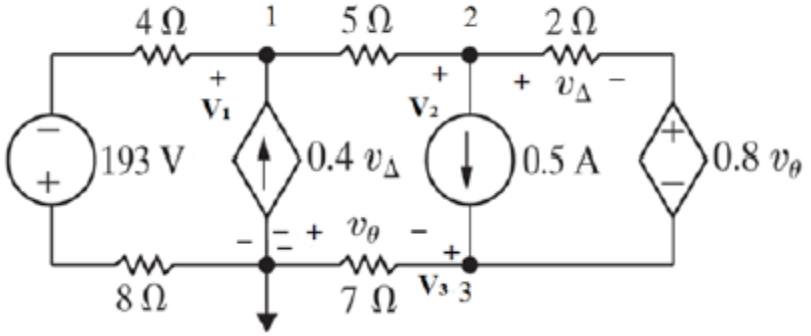
6) The node voltage equation at node 1 in the circuit to the right is

A. $\frac{V_1-193}{12} - 0.4v_\Delta + \frac{V_1-V_2}{5} = 0$

B. $\frac{V_1-193}{4} + 0.4v_\Delta + \frac{V_1-V_2}{5} = 0$

C. $\frac{V_1+193}{12} - 0.4v_\Delta + \frac{V_1-V_2}{5} = 0$

D. $\frac{V_1+193}{4} + 0.4v_\Delta + \frac{V_1-V_2}{5} = 0$



Sample Questions

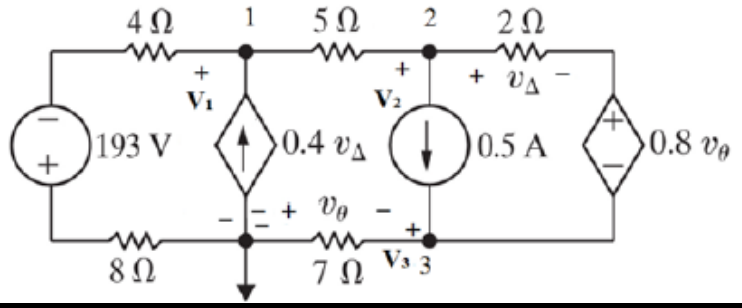
7) The node voltage equation at node 2 in the circuit to the right is

A. $\frac{V_2-V_1}{5}+0.5+\frac{V_2-0.8v_\theta-V_3}{2}=0$

B. $\frac{V_1-V_2}{5}-0.5+\frac{V_2-0.8v_\theta+V_3}{2}=0$

C. $\frac{V_2-V_1}{5}-0.5+\frac{V_2-0.8v_\theta}{2}=0$

D. $\frac{V_1-V_2}{5}+0.5+\frac{V_2-0.8v_\theta}{2}=0$



Sample Questions

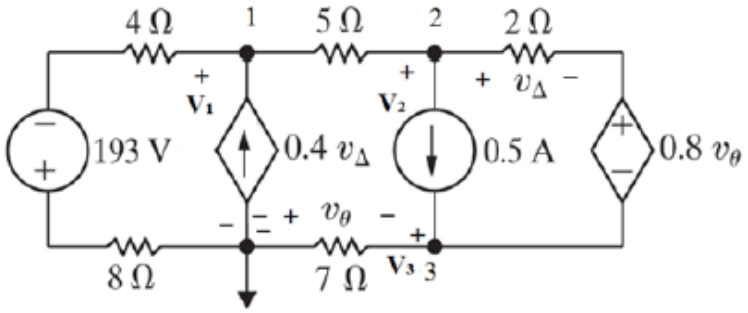
8) The node voltage equation at node 3 in the circuit to the right is

A. $\frac{V_3}{7} + 0.5 + \frac{V_3 - 0.8v_\theta - V_2}{2} = 0$

B. $\frac{V_3}{7} - 0.5 + \frac{V_3 - 0.8v_\theta - V_2}{2} = 0$

C. $\frac{V_3}{7} - 0.5 + \frac{V_3 + 0.8v_\theta - V_2}{2} = 0$

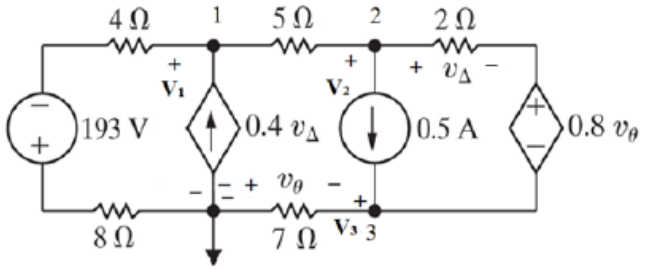
D. $\frac{V_3}{7} + 0.5 + \frac{V_3 + 0.8v_\theta - V_2}{2} = 0$



Sample Questions

9) The v_θ in the circuit to the right is equal to

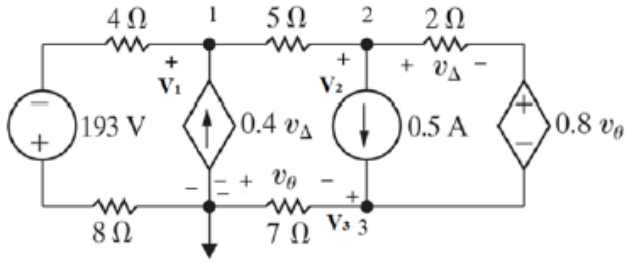
A. $-V_1$
B. $-V_2$
C. $-V_3$
D. 0



Sample Questions

10) The v_Δ in the circuit to the right is equal to

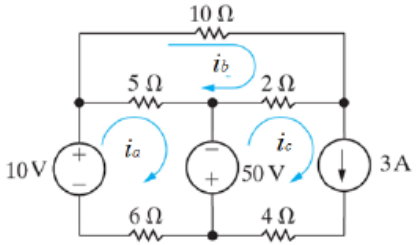
A. $\frac{V_2+0.8v_\theta-V_3}{2}$
B. $V_2 - 0.8v_\theta - V_3$
C. $\frac{V_2-0.8v_\theta}{2}$
D. $V_2 + 0.8v_\theta$



Sample Questions

11) The mesh-current equation of mesh **a** in the circuit to the right is

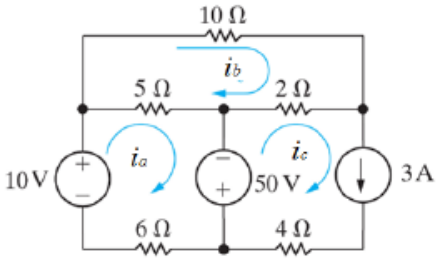
A. $11i_a - 6i_b + 50 = 0$
B. $11i_a - 5i_b - 50 = 0$
C. $11i_a - 6i_b + 60 = 0$
D. $11i_a - 5i_b - 60 = 0$



Sample Questions

12) The mesh-current equation of mesh **b** in the circuit to the right is

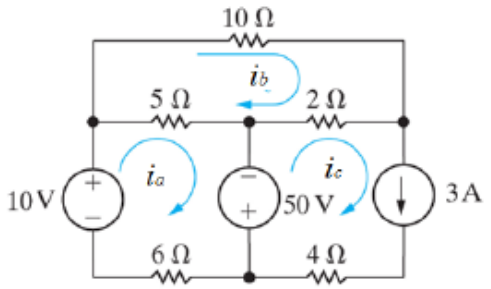
A. $-5i_a + 17i_b - 2i_c = 0$
B. $-2i_a - 17i_b - 5i_c = 0$
C. $-5i_a + 10i_b - 2i_c = 0$
D. $-2i_a - 10i_b - 5i_c = 0$



Sample Questions

13) The mesh-current equation of mesh **c** in the circuit to the right is

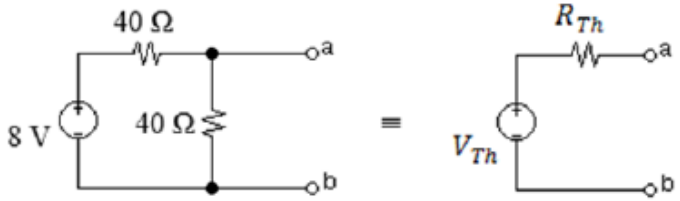
A. $6i_c - 2i_b - 50 = 0$
B. $6i_c - 2i_b + 50 = 0$
C. $4i_c - 2i_b - 50 = 0$
D. $i_c = 3\ A$



Sample Questions

14) The Thévenin equivalent resistance at the terminals **a and b** in the circuit below is

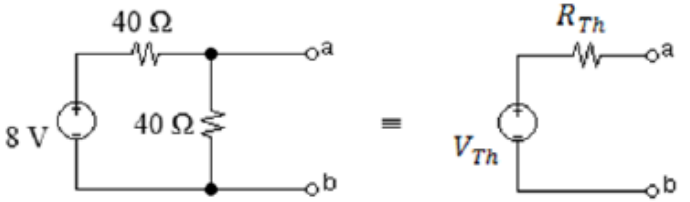
A. 10 Ω
B. 20 Ω
C. 40 Ω
D. 80 Ω



Sample Questions

15) The Thévenin equivalent voltage V_{Th} at the terminals a and b in the circuit below is

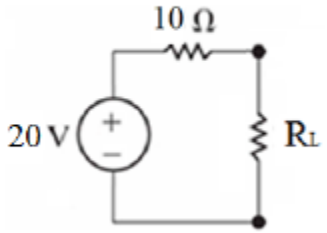
A. 3 V
B. -3 V
C. 4 V
D. -4 V



Sample Questions

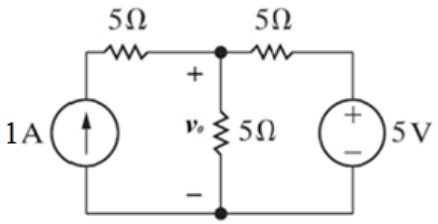
16) The maximum power transferred to the R_L is

A. 5 W
B. 10 W
C. 40 W
D. 200 W



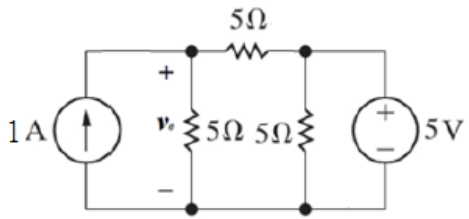
Sample Free Response Questions

1) **Using the source transformation** to find the voltage v_0 in the circuit below



Sample Free Response Questions

2) **Using the superposition principle method** to find the voltage v_0 in the following circuit



Bonus Questions

Bonus question (10 pts/each)

In the circuit below, if it is only driven by the independent voltage source, $i_\Delta = 0.5\ A$. If it is only driven by the independent current source, $i_\Delta = -0.1\ A$. If the value of the voltage source is changed to 60 V and the value of the current source is changed to 8 A, and both sources are applied to the circuit, i_Δ is equal to

A. 0.1 A
B. 0.2 A
C. 0.6 A
D. 1.0 A