ENGR 2910-101: Circuit Analysis   MIDTERM EXAM 1

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This is a closed-book exam. You are allowed to provide your own equation sheet that must be handed in with your exam paper. No worked examples are allowed on the equation sheet. You are allowed to use calculators but you are not allowed to access the internet for information.

Show all your working to ensure you obtain full points. Partial credit will be given for correct algebraic steps if you fail to obtain the correct final answer.

Question 1 [2 pts]

The voltage (v) and current (i) at the terminals of a circuit are given by:

$$v(t) = 15e^{-250t},$$
$$i(t) = 40e^{-250t}.$$

At what time does the power achieve its maximum value? (Circle one answer.)

(a) $t \to \infty$

(b) There is no maximum value

(c) $t = 0$ s

(d) $t = 1/250$ s

Question 2 [2 pts]

Complete the following definition: "The voltage across a circuit element is the work required to move..." (Circle one answer.)

(a) "...a unit positive charge from the negative terminal to the positive teminal."

(b) "...a unit positive charge from the positive terminal to the negative teminal."

(c) "...a unit negative charge from the negative terminal to the positive teminal."

(d) "...an electron from the positive terminal to the negative teminal."

Question 3 [2 pts]

For a circuit containing only resistors in series, the equivalent resistance of the circuit is: (Circle one answer.)

(a) smaller than any individual resistance

(b) the same as at least one of the individual resistors

(c) larger than any of the individual resistors

(d) zero

Question 4 [2 pts]
Which one of the equations for power is correct? (Circle one answer.)
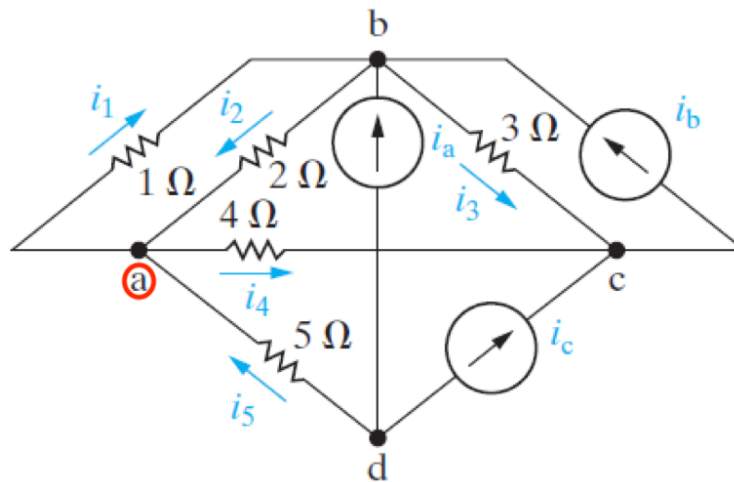
(a) $p = v^2/G$

(b) $p = v^2 G$

(c) $p = vG$

(d) $p = v/G$

Question 5 [2 pts]
For the circuit shown, which equation is correct for node a? (Circle one answer.)

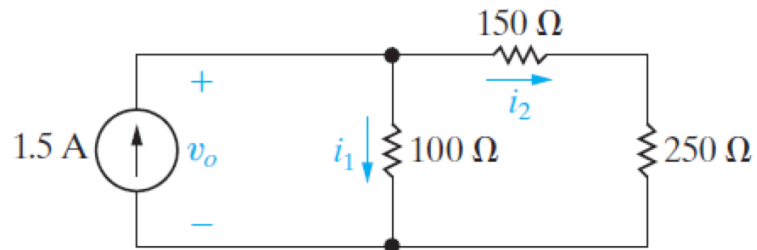(a) $-i_1 - i_4 + i_2 - i_5 = 0$

(b) $i_1 - i_4 - i_2 - i_5 = 0$

(c) $i_1 + i_4 + i_2 + i_5 = 0$

(d) $i_1 + i_4 - i_2 - i_5 = 0$

Question 6 [6]
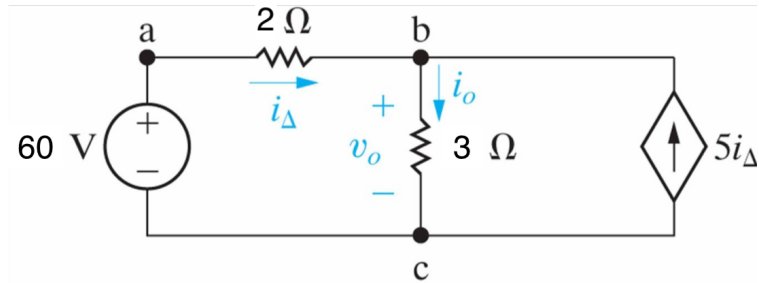
Using Kirchoff's Laws for the circuit shown below, find:

(i) the currents i_1 and i_2,
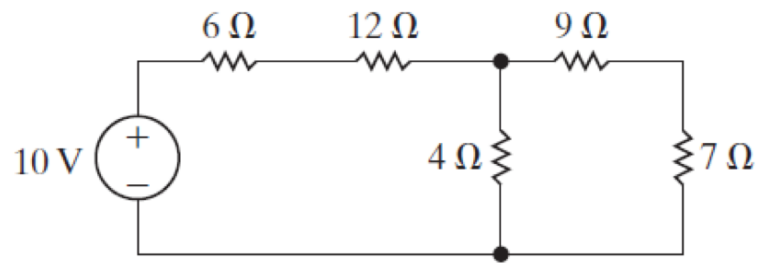
(ii) the voltage v_o.

Question 7 [6]

Using Kirchoff's Laws for the circuit shown below, find:

(i) the currents i_Δ and i_o,
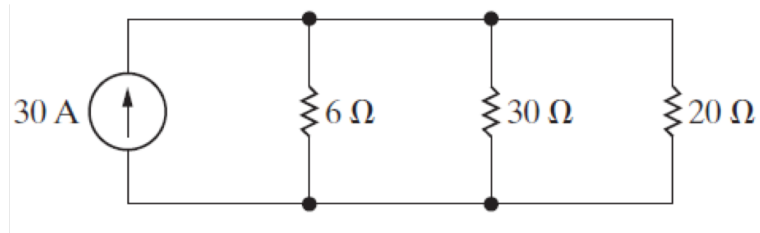
(ii) the voltage v_o.

Question 8 [4]

Find the equivalent resistance and hence the power developed by the voltage source.

Question 9 [6]

Using current division, find the power dissipated in the 30Ω resistor.

30 A 6 Ω 30 Ω 20 Ω

Question 10 [8]

Use a Δ-to-Y transformation on the $60\Omega - 30\Omega - 18\Omega$ resistors to find the equivalent resistance R_{ab}.