Fall 2006 Final exam review

Course: ENGR 2305 Circuit Analysis

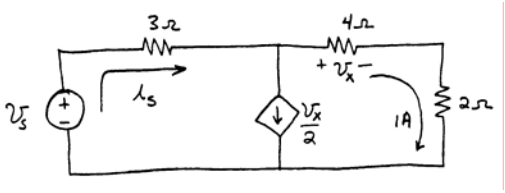
QUESTION NO. 1
List two of the four reasons why other engineering students need to learn the fundamentals of electrical engineering.

QUESTION NO. 2
A typical "deep-cycle" battery (used for electric trolling motors for fishing boats) is capable of delivering 12 V and 5 A for a period of 10 hours. How much charge flows through the battery in this interval? How much energy is delivered by the battery?

QUESTION NO. 3
A certain type of D-cell battery that costs $0.50 is capable of producing 1.2 V and a current of 0.1 A for a period of 75 hours. Determine the cost of the energy delivered by this battery per kilowatt hour. (For comparison, the approximate cost of energy purchased from electric utilities in the United States is $0.10 per kilowatt hour.)

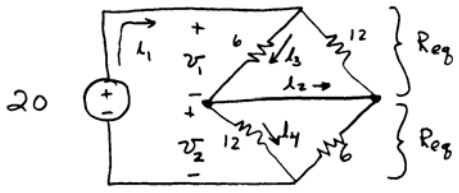
QUESTION NO. 4
A certain wire has a resistance of 0.5 Ω. Find the new resistance **a.** if the length of the wire is doubled, **b.** if the diameter of the wire is doubled.
(a) Thus, if the length of the wire is doubled, the resistance doubles to
(b) If the diameter of the wire is doubled, the cross sectional area *A* is **???.** Thus, the resistance is decreased by a factor of four to **???**

QUESTION NO. 5
The circuit shown in the following figure contains a voltage-controlled current source. Solve for v_s.

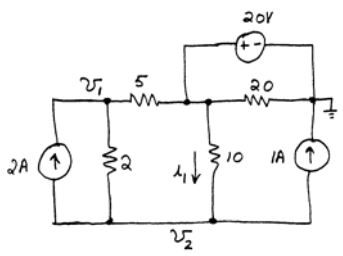


QUESTION NO. 6
Find the equivalent resistance of *n* 1000 Ω resistances in parallel. *Hints:* Find the general equation of $R_{eq.}$ in terms of n.

QUESTION NO. 7
Find the values of i_1 and i_2 in Figure as shown



QUESTION NO. 8
Use the node-voltage technique to find the value of i_1 in the following figure. Select the location of the reference node to minimize the number of unknown node voltages.



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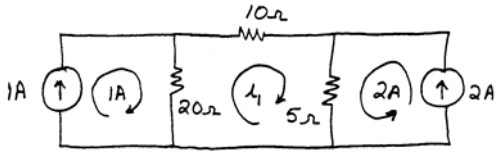
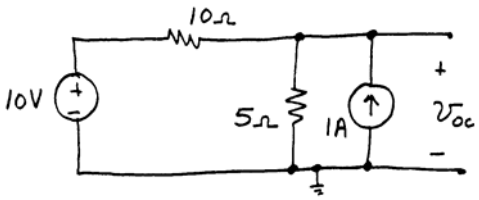
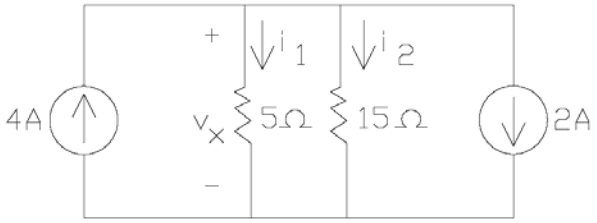
QUESTION NO. 9
Use mesh-current analysis to find the value of i_1 in the circuit of the following figure.



QUESTION NO. 10
Find the Thévenin and Norton equivalent circuits for the two-terminal circuit shown in following figure.

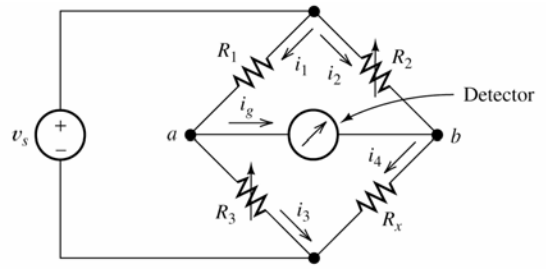


QUESTION NO. 11
Solve for i_1 in the figure as below by using superposition.



QUESTION NO. 12
a. The Wheatstone bridge shown in the following figure is balanced with R_1 = 10 kΩ, R_3 = 3419 Ω, and R_2 = 1 kΩ. Find R_x. **b.** Repeat if R_2 is 100 kΩ and the other values are unchanged.

Hints: $R_x = \frac{R_2}{R_1} R_3$



QUESTION NO. 13
Find the stored charge and energy for a 5–μF capacitor that is discharged to 1000 V. If this capacitor is discharged to 0 V in a time interval of 1 μs, find the average power delivered by the capacitor during the discharge interval.

QUESTION NO. 14
At t = 5 s, the energy stored in a 10-μF capacitor is 200 J and is decreasing at 500 J/s. Determine the voltage magnitude and current magnitude at t = 5s. Does the current enter or leave the positive terminal of the capacitor?

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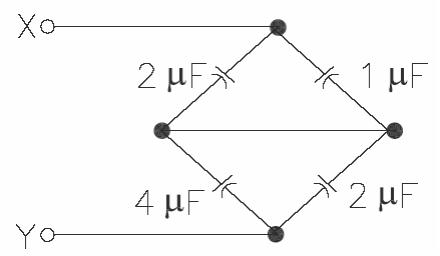
QUESTION NO. 15
We want to store sufficient energy in a 1.12-F capacitor to supply 5 horsepower (hp) for 1 hour. To what voltage must the capacitor be charged? (*Note:* One horsepower is equivalent to 745.7 watts.)

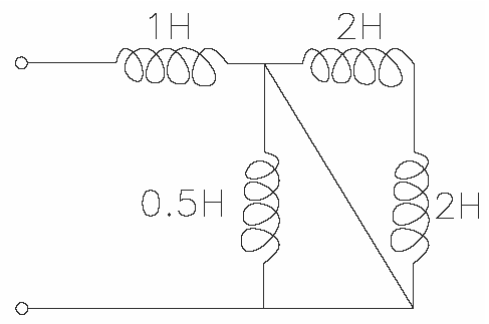
QUESTION NO. 16
Find the equivalent capacitance between terminals *x* and *y* for each of the circuits shown as follows.



QUESTION NO. 17
At *t* = 0, the current flowing in a 0.5-H inductance is 4 A. What constant voltage must be applied to reduce the current to 0 at *t* = 0.2 s?

QUESTION NO. 18
At *t* = 5 s, the energy stored in a 2-H inductor is 200 J and is increasing at 100 J/s. Determine the voltage magnitude and current magnitude at *t* = 5 s. Does the current enter or leave the positive terminal of the inductor?

QUESTION NO. 19
Find the equivalent inductance for each of the series and parallel combinations shown as follows.



QUESTION NO. 20
Consider the circuit shown in Figure P4.5. Assume that the capacitor is charged to a voltage of 50 V prior to *t* = 0. **a.** Find expression for the voltage across the capacitor $\upsilon_C(t)$ and the voltage across the resistor $\upsilon_R(t)$. **b.** Find an expression for the power delivered to the resistor.

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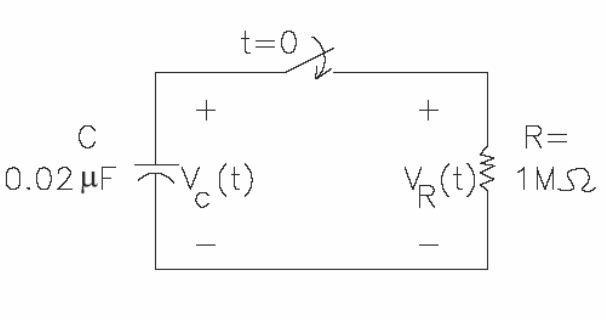
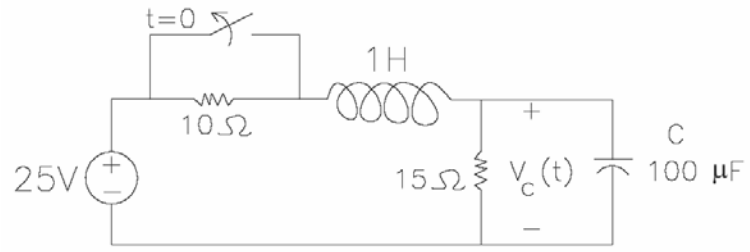


QUESTION NO. 21
When a person shuffles across a dry carpet, their body can be modeled as a charged 100-pF capacitance with one end grounded. Then, if the person touches a grounded metallic object such as a water faucet, the capacitance is discharged and the person experiences a brief shock. Typically, the capacitance may be charged to 20,000 V and the resistance (mainly of one's finger) is 100 Ω. Determine the peak current during discharge and the time constant of the shock.

QUESTION NO. 22
The circuit shown as follows has been set up for a long time prior to *t* = 0 with the switch closed. Find the value of υ_C prior to *t* = 0. Find the steady-state value of ψc after the switch has been opened for a long time.



QUESTION NO. 23
Consider a series circuit consisting of an inductance with an initial current in series with a resistance *R*. What is the time constant of this circuit? To attain a long time constant, do we need large or small values for *R*? For *L*?

And Homework Assignment on Chapter 7.

~END~