Name: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ (please print)

Signature: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

ECE 2300 – Quiz #2

February 18, 2014

Keep this quiz closed and face up until you are told to begin.

1. This quiz is closed book, closed notes. You may use one 8.5” x 11” crib sheet, or its equivalent.

2. Show all work on these pages. Show all work necessary to complete the problem. A solution without the appropriate work shown will receive no credit. A solution which is not given in a reasonable order will lose credit.

3. It is assumed that your work will begin on the same page as the problem statement. If you choose to begin your work on another page, you must indicate this on the page with the problem statement, with a clear indication of where the work can be found. **If your work continues on to another page, indicate clearly where your work can be found. Failure to indicate this clearly will result in a loss of credit.**

4. Show all units in solutions, intermediate results, and figures. Units in the quiz will be included between square brackets.

5. Do not use red ink. Do not use red pencil.

6. You will have 35 minutes to work on this quiz.

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_/20

Room for extra work

For a set of identical devices, each one can be modeled by a voltage source in series with a resistance. Each device is characterized by the plot in Figure 1, where the reference polarities are defined in Figure 2.

Assume that two of these identical devices are placed in the circuit in Figure 3. Terminal A of Device 1 is connected to A1, and terminal B of Device 1 is connected to B1. Terminal A of Device 2 is connected to A2, and terminal B of Device 2 is connected to B2.

1. Find the model for the device and draw it, labeling terminals A and B.
2. Find *vX* in Figure 3.

 



Room for extra work

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Room for extra work

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Room for extra work

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Room for extra work

For a set of identical devices, each one can be modeled by a voltage source in series with a resistance. Each device is characterized by the plot in Figure 1, where the reference polarities are defined in Figure 2.

Assume that two of these identical devices are placed in the circuit in Figure 3. Terminal A of Device 1 is connected to A1, and terminal B of Device 1 is connected to B1. Terminal A of Device 2 is connected to A2, and terminal B of Device 2 is connected to B2.

1. Find the model for the device and draw it, labeling terminals A and B.
2. Find *vX* in Figure 3.

 



Room for extra work

ECE 2300 -- Quiz #2 – February 18, 2014 – Solution, Version 1

For a set of identical devices, each one can be modeled by a voltage source in series with a resistance. Each device is characterized by the plot in Figure 1, where the reference polarities are defined in Figure 2.

Assume that two of these identical devices are placed in the circuit in Figure 3. Terminal A of Device 1 is connected to A1, and terminal B of Device 1 is connected to B1. Terminal A of Device 2 is connected to A2, and terminal B of Device 2 is connected to B2.

1. Find the model for the device and draw it, labeling terminals A and B.
2. Find *vX* in Figure 3.

 



Solution:

1. We begin drawing the equivalent circuit for the device. This circuit is given as follows.



Note that we are careful to label terminals A and B. Then, we write KVL around the closed loop to obtain



Thus, our model will be



b) Now, we have the model for the device, which we can plug into the circuit in Figure 3. So, we do this, and get the following circuit diagram.



Again, keeping the terminal labels helps us get the polarities of the voltage sources correct. Writing KCL for the top node, and writing three KVL’s, gives us





For those who are interested, we also note that



We could also approach this same problem using the techniques for writing KCL’s we developed as a part of the Node-Voltage Method. With that, we could write one equation, in one unknown for the bottom node as





ECE 2300 -- Quiz #2 – February 18, 2014 – Solution, Version 2

For a set of identical devices, each one can be modeled by a voltage source in series with a resistance. Each device is characterized by the plot in Figure 1, where the reference polarities are defined in Figure 2.

Assume that two of these identical devices are placed in the circuit in Figure 3. Terminal A of Device 1 is connected to A1, and terminal B of Device 1 is connected to B1. Terminal A of Device 2 is connected to A2, and terminal B of Device 2 is connected to B2.

1. Find the model for the device and draw it, labeling terminals A and B.
2. Find *vX* in Figure 3.

 



Solution:

1. We begin drawing the equivalent circuit for the device. This circuit is given as follows.



Note that we are careful to label terminals A and B. Then, we write KVL around the closed loop to obtain



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ECE 2300 -- Quiz #2 – February 18, 2014 – Solution, Version 3

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1. Find the model for the device and draw it, labeling terminals A and B.
2. Find *vX* in Figure 3.

 



Solution:

1. We begin drawing the equivalent circuit for the device. This circuit is given as follows.



Note that we are careful to label terminals A and B. Then, we write KVL around the closed loop to obtain



Thus, our model will be



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ECE 2300 -- Quiz #2 – February 18, 2014 – Solution, Version 4

For a set of identical devices, each one can be modeled by a voltage source in series with a resistance. Each device is characterized by the plot in Figure 1, where the reference polarities are defined in Figure 2.

Assume that two of these identical devices are placed in the circuit in Figure 3. Terminal A of Device 1 is connected to A1, and terminal B of Device 1 is connected to B1. Terminal A of Device 2 is connected to A2, and terminal B of Device 2 is connected to B2.

1. Find the model for the device and draw it, labeling terminals A and B.
2. Find *vX* in Figure 3.

 



Solution:

1. We begin drawing the equivalent circuit for the device. This circuit is given as follows.



Note that we are careful to label terminals A and B. Then, we write KVL around the closed loop to obtain



Thus, our model will be



b) Now, we have the model for the device, which we can plug into the circuit in Figure 3. So, we do this, and get the following circuit diagram.



Again, keeping the terminal labels helps us get the polarities of the voltage sources correct. Writing KCL for the top node, and writing three KVL’s, gives us





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