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

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

ECE 2300 – Quiz #1

February 4, 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 30 minutes to work on this quiz.

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

Room for extra work

Five subsystems, labeled A, B, C, D, and E, are connected as shown in the circuit diagram given below. The currents in this circuit are made up of the flow of electrons. The currents and voltages are defined in the equations given below. Each subsystem represents a different area in an electrical pulsed-power system.

1. Are the electrons gaining or losing energy as they move through Subsystem B at *t* = 4[ms]? Explain your answer.
2. Find the power absorbed by Subsystem C at *t* = 1.5[ms].
3. Find the energy delivered by Subsystem A during the third [millisecond] after *t* = 0.





Room for extra work

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

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

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2. Find the power absorbed by Subsystem C at *t* = 1.5[ms].
3. Find the energy delivered by Subsystem A during the third [millisecond] after *t* = 0.





Room for extra work

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

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

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February 4, 2014

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1. Are the electrons gaining or losing energy as they move through Subsystem B at *t* = 4[ms]? Explain your answer.
2. Find the power absorbed by Subsystem C at *t* = 1.5[ms].
3. Find the energy delivered by Subsystem A during the third [millisecond] after *t* = 0.





Room for extra work

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

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ECE 2300 – Quiz #1

February 4, 2014

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

Room for extra work

Five subsystems, labeled A, B, C, D, and E, are connected as shown in the circuit diagram given below. The currents in this circuit are made up of the flow of electrons. The currents and voltages are defined in the equations given below. Each subsystem represents a different area in an electrical pulsed-power system.

1. Are the electrons gaining or losing energy as they move through Subsystem B at *t* = 4[ms]? Explain your answer.
2. Find the power absorbed by Subsystem C at *t* = 1.5[ms].
3. Find the energy delivered by Subsystem A during the third [millisecond] after *t* = 0.





Room for extra work

ECE 2300 -- Quiz #1 – February 4, 2014 – Solution – Version 1

Five subsystems, labeled A, B, C, D, and E, are connected as shown in the circuit diagram given below. The currents in this circuit are made up of the flow of electrons. The currents and voltages are defined in the equations given below. Each subsystem represents a different area in an electrical pulsed-power system.

1. Are the electrons gaining or losing energy as they move through Subsystem B at *t* = 4[ms]? Explain your answer.
2. Find the power absorbed by Subsystem C at *t* = 1.5[ms].
3. Find the energy delivered by Subsystem A during the third [millisecond] after *t* = 0.





Solution:

1. We note that the voltage across Subsystem B is *vB*, and the current through Subsystem B is *iB*, and that for Subsystem B *vB* and *iB* are in the active sign convention. So, we can write

Looking at the equations for *vB* and *iB*, it should be clear that at *t* = 4[ms], *vB* is positive and *iB* is positive. In fact, both will be positive for all time. Thus, the power absorbed by Subsystem B will be negative, which is the same thing as saying that the power delivered is positive. Thus the charge carriers moving through Subsystem B must be gaining energy. This is because the power delivered in that Subsystem is positive, at that point in time.
Note that we do not care about the nature of the charge carriers for this analysis. Note also that we do not need a value for the power to answer this question, only the sign.
2. For Subsystem C, we know that since *vC* and *iC* are in the active sign convention for Subsystem C, that


3. We can write,

So, to get the energy, we integrate of the time period from 2[ms] to 3[ms], which would be the third [millisecond] after *t* = 0. For this integral, we need the expressions for *vA* and *iA* for this time period, which we get from the equations above. Then, we integrate,

So, our solution, using our calculator to integrate, is


Version 2

Five subsystems, labeled A, B, C, D, and E, are connected as shown in the circuit diagram given below. The currents in this circuit are made up of the flow of electrons. The currents and voltages are defined in the equations given below. Each subsystem represents a different area in an electrical pulsed-power system.

1. Are the electrons gaining or losing energy as they move through Subsystem B at *t* = 4[ms]? Explain your answer.
2. Find the power absorbed by Subsystem C at *t* = 1.5[ms].
3. Find the energy delivered by Subsystem A during the third [millisecond] after *t* = 0.





Solution:

1. We note that the voltage across Subsystem B is *vB*, and the current through Subsystem B is *iB*, and that for Subsystem B *vB* and *iB* are in the active sign convention. So, we can write

Looking at the equations for *vB* and *iB*, it should be clear that at *t* = 4[ms], *vB* is positive and *iB* is positive. In fact, both will be positive for all time. Thus, the power absorbed by Subsystem B will be negative, which is the same thing as saying that the power delivered is positive. Thus the charge carriers moving through Subsystem B must be gaining energy. This is because the power delivered in that Subsystem is positive, at that point in time.
Note that we do not care about the nature of the charge carriers for this analysis. Note also that we do not need a value for the power to answer this question, only the sign.
2. For Subsystem C, we know that since *vC* and *iC* are in the active sign convention for Subsystem C, that


3. We can write,

So, to get the energy, we integrate of the time period from 2[ms] to 3[ms], which would be the third [millisecond] after *t* = 0. For this integral, we need the expressions for *vA* and *iA* for this time period, which we get from the equations above. Then, we integrate,

So, our solution, using our calculator to integrate, is


Version 3

Five subsystems, labeled A, B, C, D, and E, are connected as shown in the circuit diagram given below. The currents in this circuit are made up of the flow of electrons. The currents and voltages are defined in the equations given below. Each subsystem represents a different area in an electrical pulsed-power system.

1. Are the electrons gaining or losing energy as they move through Subsystem B at *t* = 4[ms]? Explain your answer.
2. Find the power absorbed by Subsystem C at *t* = 1.5[ms].
3. Find the energy delivered by Subsystem A during the third [millisecond] after *t* = 0.





Solution:

1. We note that the voltage across Subsystem B is *vB*, and the current through Subsystem B is *iB*, and that for Subsystem B *vB* and *iB* are in the active sign convention. So, we can write

Looking at the equations for *vB* and *iB*, it should be clear that at *t* = 4[ms], *vB* is positive and *iB* is positive. In fact, both will be positive for all time. Thus, the power absorbed by Subsystem B will be negative, which is the same thing as saying that the power delivered is positive. Thus the charge carriers moving through Subsystem B must be gaining energy. This is because the power delivered in that Subsystem is positive, at that point in time.
Note that we do not care about the nature of the charge carriers for this analysis. Note also that we do not need a value for the power to answer this question, only the sign.
2. For Subsystem C, we know that since *vC* and *iC* are in the active sign convention for Subsystem C, that


3. We can write,

So, to get the energy, we integrate of the time period from 2[ms] to 3[ms], which would be the third [millisecond] after *t* = 0. For this integral, we need the expressions for *vA* and *iA* for this time period, which we get from the equations above. Then, we integrate,

So, our solution, using our calculator to integrate, is


Version 4

Five subsystems, labeled A, B, C, D, and E, are connected as shown in the circuit diagram given below. The currents in this circuit are made up of the flow of electrons. The currents and voltages are defined in the equations given below. Each subsystem represents a different area in an electrical pulsed-power system.

1. Are the electrons gaining or losing energy as they move through Subsystem B at *t* = 4[ms]? Explain your answer.
2. Find the power absorbed by Subsystem C at *t* = 1.5[ms].
3. Find the energy delivered by Subsystem A during the third [millisecond] after *t* = 0.





Solution:

1. We note that the voltage across Subsystem B is *vB*, and the current through Subsystem B is *iB*, and that for Subsystem B *vB* and *iB* are in the active sign convention. So, we can write

Looking at the equations for *vB* and *iB*, it should be clear that at *t* = 4[ms], *vB* is positive and *iB* is positive. In fact, both will be positive for all time. Thus, the power absorbed by Subsystem B will be negative, which is the same thing as saying that the power delivered is positive. Thus the charge carriers moving through Subsystem B must be gaining energy. This is because the power delivered in that Subsystem is positive, at that point in time.
Note that we do not care about the nature of the charge carriers for this analysis. Note also that we do not need a value for the power to answer this question, only the sign.
2. For Subsystem C, we know that since *vC* and *iC* are in the active sign convention for Subsystem C, that


3. We can write,

So, to get the energy, we integrate of the time period from 2[ms] to 3[ms], which would be the third [millisecond] after *t* = 0. For this integral, we need the expressions for *vA* and *iA* for this time period, which we get from the equations above. Then, we integrate,

So, our solution, using our calculator to integrate, is
