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

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

ECE 2201 – Quiz #1 – 1pm Section

February 15, 2024

Do not open this quiz until you are told to begin.

1. Print your name, and sign your name, at the top of this page.
2. This quiz is closed book, closed notes. You may use one 8.5” x 11” crib sheet, or its equivalent. You may use a calculator. You should **not** use a cell phone, tablet computer, or laptop computer, as you work on this quiz.
3. Show all work on these pages, and you may use both sides of each page. 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. You may separate the pages as you work.
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 40 minutes to work on this quiz.

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

Room for extra work

Use the circuit below to solve. The equations for currents and voltages are shown below. The charge carriers are electrons.

 

1. Find the power absorbed by Device 1 at *t* = 0.
2. Find the power delivered by Device 1 at *t* = 2.3[ms].
3. Find the energy absorbed by Device 1 during the fourth [millisecond], counting [milliseconds] starting at *t* = 3[ms].
4. Are the electrons moving through Device 1 gaining or losing energy at   
   *t* = 2.3[ms]? Explain your answer using complete sentences.

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Room for extra work

**Solutions:**

Use the circuit below to solve. The equations for currents and voltages are shown below. The charge carriers are electrons.

 

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   *t* = 2.3[ms]? Explain your answer using complete sentences.

**Solution follows:**

1. For this part, we need an expression for the power absorbed by Device 1. Since *vA* and *iB* are in the active sign relationship for Device 1, we can write:



We can then plug in values, to obtain





1. Our approach here is similar. We write



To plug in the values here, we need to either convert the radians into degrees, or convert the degrees into radians. We will choose here to convert radians into degrees, so we have



Solving, we get



1. To get this, we need to integrate the power. The limits of the integral will be over a [millisecond], which is from



six to seven [milliseconds], as we can see from the number line above. So, we can write



We previously saw that 410[rad/s] could be converted to 23,491[deg/s], so we can write



Evaluating this integral, we get



1. In part b), we found that the power delivered by Device 1 at *t* = 2.3[ms] was positive. This means that, in Device 1, energy is being delivered to the electrical system at this time. Therefore, the electrons must be  
    gaining energy at 2.3[ms] as they move through Device 1.

There are four versions of this quiz, each with a different angular frequency, w.

For w = 420[rad/s], we have:

1. 
2. 
3. 
4. gaining energy

For w = 430[rad/s], we have:

1. 
2. 
3. 
4. gaining energy

For w = 440[rad/s], we have:

1. 
2. 
3. 
4. gaining energy