**ECE 2201 – Circuit Analysis I**

**Homework #1**

These assignments are available on the web at:

<http://courses.egr.uh.edu/ECE/ECE2201/Homework/>

Your solutions, with all of the work necessary to complete the problems, are to be submitted on Blackboard. This means that your work should be done on paper and scanned, or worked on a tablet or other device that produces electronic documents directly. The due dates are available on Blackboard.

Homework turned in after the due date and time will receive a grade of zero (0).

Please read the instructions on the next page concerning notation (*Notation in Circuit Analysis*). These rules will be applied throughout the semester. In writing all your homework assignments, quizzes, and exams, we expect you to follow them. There will be significant credit deduction for not doing so.

**Notation in Circuit Analysis**

Getting notation right is an important part of what we want to teach you in ECE 2201 and ECE 2202. Below you will find rules concerning notation that we expect you to follow. Here we cover voltage, current, and power. In later homework assignments, we will review rules associated with other quantities. If these rules are not followed, you can expect to lose credit on homework, quizzes, and exams.

***Circuit Variables***

Voltage and current are the principal circuit variables we will encounter. The rules for labeling these are as follows. Examples are shown in the figure below.

* All voltages are labeled with a lower case *v* and a subscript; the subscript may be letters, numbers, or a combination of letters and numbers. A “plus” and “minus” sign must be assigned to each voltage to show the reference polarity. The voltage variable “*v*” must lie on a straight line between the “plus” and “minus” signs. Do not draw the straight line.
* All currents are labeled with a lower case *i* and a subscript; the subscript may be letters, numbers, or a combination of letters and numbers. An arrow must be assigned to each current to show the reference direction. The current indicator “*i*” must be placed near the arrow.
* All voltages and currents used in equations must be labeled on a circuit diagram; otherwise, that variable is “undefined”.

Do not show a “*v*” without + and – signs; do not show + and – signs without a *v*. Do not show an “*i*” without an arrow; do not show an arrow without an “*i*”. These things have no meaning.



***Power and Energy***

Power is indicated by a lower case “*p*”. It is the product of voltage and current, but the interpretation of the results is also important, and must be indicated in the labeling. When calculating power, your notation must show (1) whether the power you are calculating is absorbed or delivered and (2) which circuit element you are calculating power for. This can be done as follows: if you are calculating the power delivered by current source *iS1*, you would indicate this as *pdel by iS1*; if you are calculating the power absorbed by resistor R5, you could indicate this as *pabs by R5*.

Energy (indicated by lower case “*w*”) is the time integral of the power. In calculating energy you should follow the same notation rules as for power.

***Notation***

**1.**

a) Label voltages across devices A and B using labeling rules stated above. Note that there is more than one correct answer.

b) Label currents through devices A and B using labeling rules stated above. Note that there is more than one correct answer.

**2.**

a) If *v*C = -5[V], is the reference polarity in the same direction as the actual polarity?

b) If *v*C = -5[V], which of terminals 1 and 2 is at the higher potential?

c) If *v*C = 5[V], which of terminals 1 and 2 is at the higher potential?

**3.**

a) Label reference currents through all elements using labeling rules provided.

b) Based on your labels, is the current going through device \_\_\_ necessarily the same as current through \_\_\_? (Answer Yes/No for the four cases below.)

 A, B \_\_\_\_\_ B, D \_\_\_\_\_

 A, C \_\_\_\_\_ B, C \_\_\_\_\_

***Units***

**4.**

Power has units of energy per time. Show that voltage [V] multiplied by current [A] gives power in Watts. Do this by breaking voltage, current, and power into more fundamental units.

***Power and Charge***

**5.**

a) If for device D *v*D = 5[V] and *i*D = 10 [mA], what is the power absorbed by D?

b) If for device D’ *v*D’ = 5[V] and *i*D’ = 10 [mA], what is the power absorbed by D’?

**6.**

a) Is device A labeled in the passive or active sign relationship?

b) Is device C labeled in the passive or active sign relationship?

c) If vC = -3[V] and iC = 20[mA], what is the sign relationship for device C?

d) If iA = - 100[mA], what is the sign relationship for device A?

**7.**

a) In the diagram to the left, the current *iD* = 250[mA], and the voltage *vD* = - 25 [V]. How much charge passes through D in 3.6 [s]? If the current is being carried by electrons, which way are the electrons going?

b) For the current and voltage specified in part a), how much energy is delivered to D in 3.6 [s]?

**8.**

Consider the device D shown.

a) Write an expression for the power delivered to D if *iD* = -100[mA] and

 $v\_{D}\left(t\right)=(12[V]-1.6\left[Vs^{-1}\right]t)$. The expression for *vD(t)* is considered valid for *t* > 0 [s].

b) Given the voltage and current specified in **8 a)**, find the energy delivered to D between *t* = 0 and *t* = 2 [s].

**9.**

Repeat problem **8** for $v\_{D}\left(t\right)=\left(12e^{-0.2\left[s^{-1}\right]t}\right) $[V], *t* > 0 [s].