**ECE 2202 – Circuit Analysis II**

**Homework #1**

These assignments are available on the web at:

<http://courses.egr.uh.edu/ECE/ECE2202/Homework/>

Homework will be submitted to Blackboard unless otherwise indicated. The due date will be indicated on the class schedule (available on Blackboard). Homework is due at the start of class.

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 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 a letter or number. A “plus” and “minus” sign must be assigned to each voltage to show the reference polarity. The voltage indicator “*v*” must lie on a line with the “plus” and “minus” signs.
* All currents are labeled with a lower case *i* and a subscript; the subscript may be a letter or number. 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 (i) whether the power you are calculating is absorbed or delivered and (ii) 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.

ECE 2202 – CIRCUIT ANALYSIS II

HOMEWORK #1

1. For the circuit shown find the Thevenin equivalent circuit with respect to terminals a and b. Draw the Thevenin equivalent circuit. On this circuit, specify the Thevenin voltage and resistance, and positive reference for the Thevenin voltage, and the locations of terminals a and b.



2. Use the circuit given below to solve this problem.

a) Find the Norton equivalent as seen by the 10[V] voltage source in the circuit below.

b) Find the power delivered by the 10[V] voltage source in the circuit below.



3. Use the circuit below to find the numerical quantities specified.

1. Find the Thevenin equivalent of this circuit as seen by the voltage source.
2. Find the power delivered by the voltage source in this circuit.
3. Use superposition to find the voltage *vW*.



4. Use the circuit shown to solve this problem.

1. Find the Thevenin equivalent as seen by the 5[mA] current source.
2. Find the power delivered by the 5[mA] current source.



5. For the speaker in this circuit, the voltage across it is always proportional to the current through it. Find the maximum amount of power that the circuit can deliver to the speaker.



6. A device has an equivalent circuit as shown in Figure 1. The equivalent is between two terminals, labeled *a* and *b*. Three identical versions of this device are connected in the circuit in Figure 2, with terminals *a* and *b* shown for each device, to indicate the polarity. Find the Thevenin equivalent resistance as seen by the 20[mA] current source in Figure 2.





7. Three identical devices have been connected as shown in the circuit in Figure 1. Each device has terminals *a* and *b* as shown in Figure 2. The orientations of the devices in Figure 1 are shown by the terminal names with a number added to indicate the terminals of the three devices.

The open-circuit voltage at terminal *D* with respect to *C* was measured, and found to be 2.57[V]. When a 1[k] resistor is placed across terminals *C* and *D*, then the voltage at *D* with respect to *C* was found to be -4.59[V]. Find the Thevenin equivalent of the device, and draw it, labeling terminals *a* and *b*.

 

8. Use the circuit below to solve. The power absorbed by *RL* is the largest possible, when *RL* is 2.7[]. Find the value of *X* that makes this statement valid. Include any appropriate units in your solution.



Selected Numerical Solutions:

1. *vTH* = -46.51[V]

2. b) *pDEL.BY.VS* = -73[mW]

3. b) *pDEL.BY.vS1* = -372[mW]

4. b) *pDEL.BY.5[mA]CS* = -16.7[mW]

5. 

6. *RTH* = -1.07[k]

7. *RTH* = -2.34[k], *vTH* = +/-3.86[V] (The sign is not arbitrary, but rather it depends on the reference polarity of the voltage source, with respect to the terminals that are labeled *a* and *b*.)

8. *X* = -5.147[]