DC Circuits Laboratory **Lab # 4**

Schematic Capture with Multisim

Lab Objectives

1. To learn how to use Multisim, a circuit simulation package.
2. To analyze a multiple-source DC Circuit using Multisim.

Pre-Laboratory Preparation

Prior to your scheduled laboratory meeting time the following items need to be completed...

1. Launch Multisim from one of the RIT ECTET laboratory computers and download and read the "Getting Started" PDF that can be found under the HELP tab. Work the tutorial through the bottom of page 15 (the Analysis section).

On Line Learning

2. Watch the following two videos on determining node voltages for DC circuits within Multisim (*if either video doesn't load, SEARCH for the listed topic by title and watch a short video or two*)

a. NI Multisim: Find node voltages with DC Operating Point Analysis

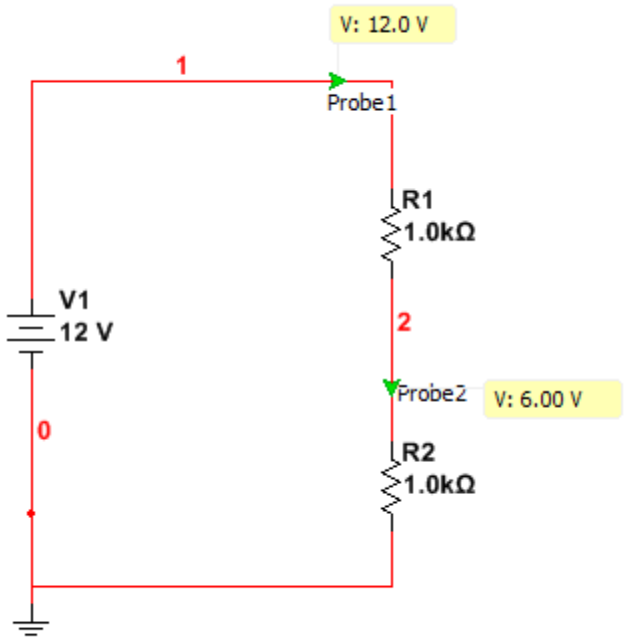
Video 1: http://www.youtube.com/watch?v=gXBCqP17AZs

b. NI Multisim: Measure DC Node voltage with a measurement probe

Video 2: http://www.youtube.com/watch?v=svNGHA2-uK4

3. Using techniques from the "Getting Started" handout and the videos, build and simulate the simple circuit shown in **Figure A** below **using Multisim**. Use the information from the videos or "Getting Started" PDF to print out the simulation table and voltage probes (as in Part 1 and 2 of the Lab Procedure).
4. Read this ENTIRE HANDOUT and bring questions to lab. *Note – there are individual signoffs in Part 1 and Part 2 of this lab*. **The prelab quiz will be based on your prelab preparation/results.**

Figure A. Practice Circuit A



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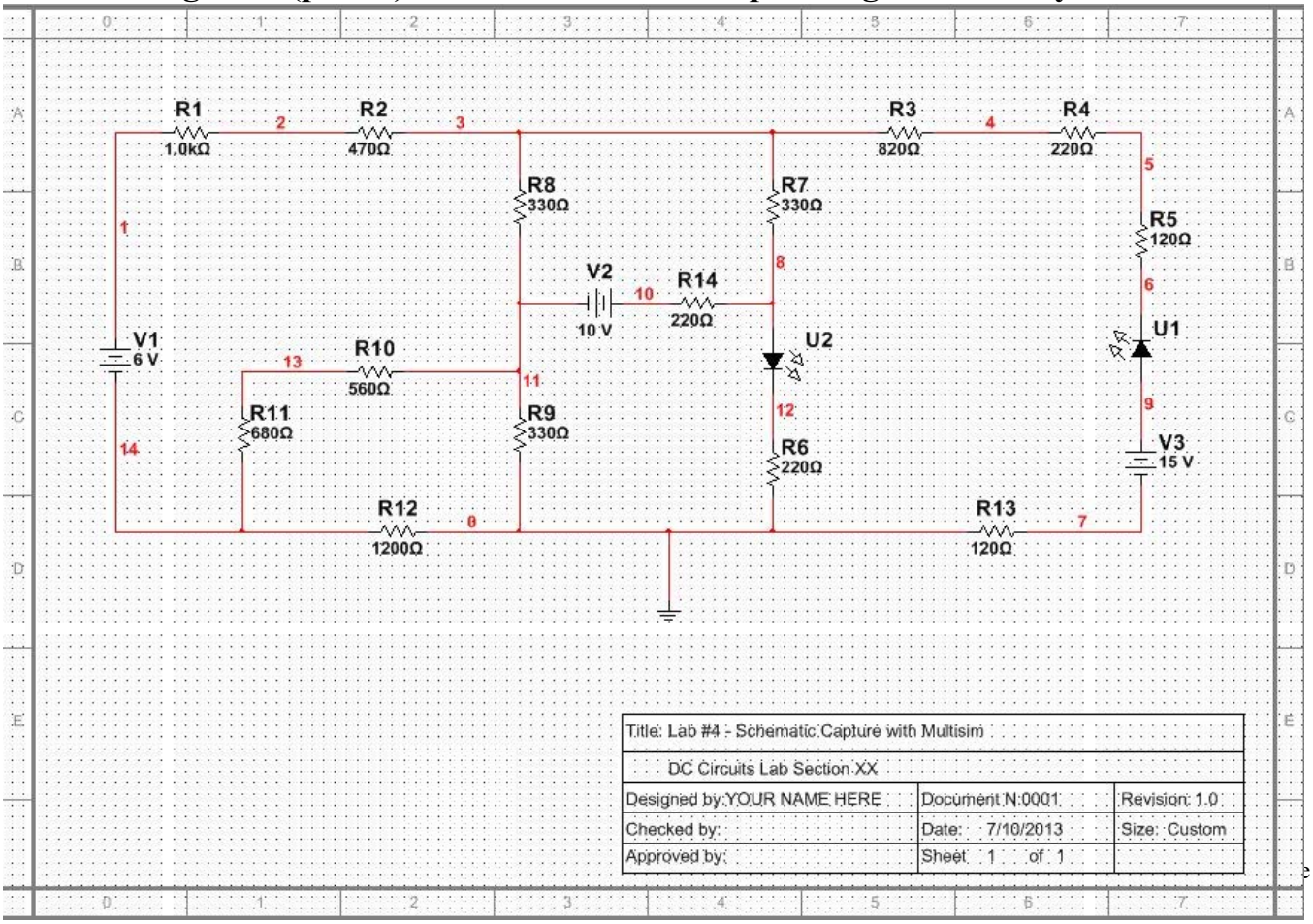
DC Circuits Lab Procedure:

PART 1 – Schematic Entry and Circuit Analysis using DC Operating Point (individual work)

1. Using Multisim, create the circuit shown in Figure 1
   a. Your component values and reference designators should be the same as in Figure 1.
   b. Make sure LEDs U_1 and U_2 are placed in the circuit in the proper orientation and use the part **LED_red.**
   c. Your net labels will not necessarily be the same as shown in Figure 1 but make certain they are visible (see Video 1 under pre-lab prep).
   d. Include the title block shown in the lower right hand corner of your page (Default V6.tb7) and fill in your section number and name, otherwise leave the default information.
   e. Resize the page to minimize white space (see OPTIONS, SHEET PROPERTIES).
   f. PRINT your circuit as a full 8 ½ by 11" sheet using "scale to fit."
2. Using the technique shown in Video 1 from the pre-lab, create a table listing all of the node voltages in the circuit.
   a. PRINT this table
      i. **The node voltages should be in numerical order (V(1), V(2), V(3)…)**
   b. Have your lab instructor review and sign your team cover page under Part I, your name. **This is an individual sign-off.**

Figure 1 (part 1) - Schematic for DC Operating Point Analysis



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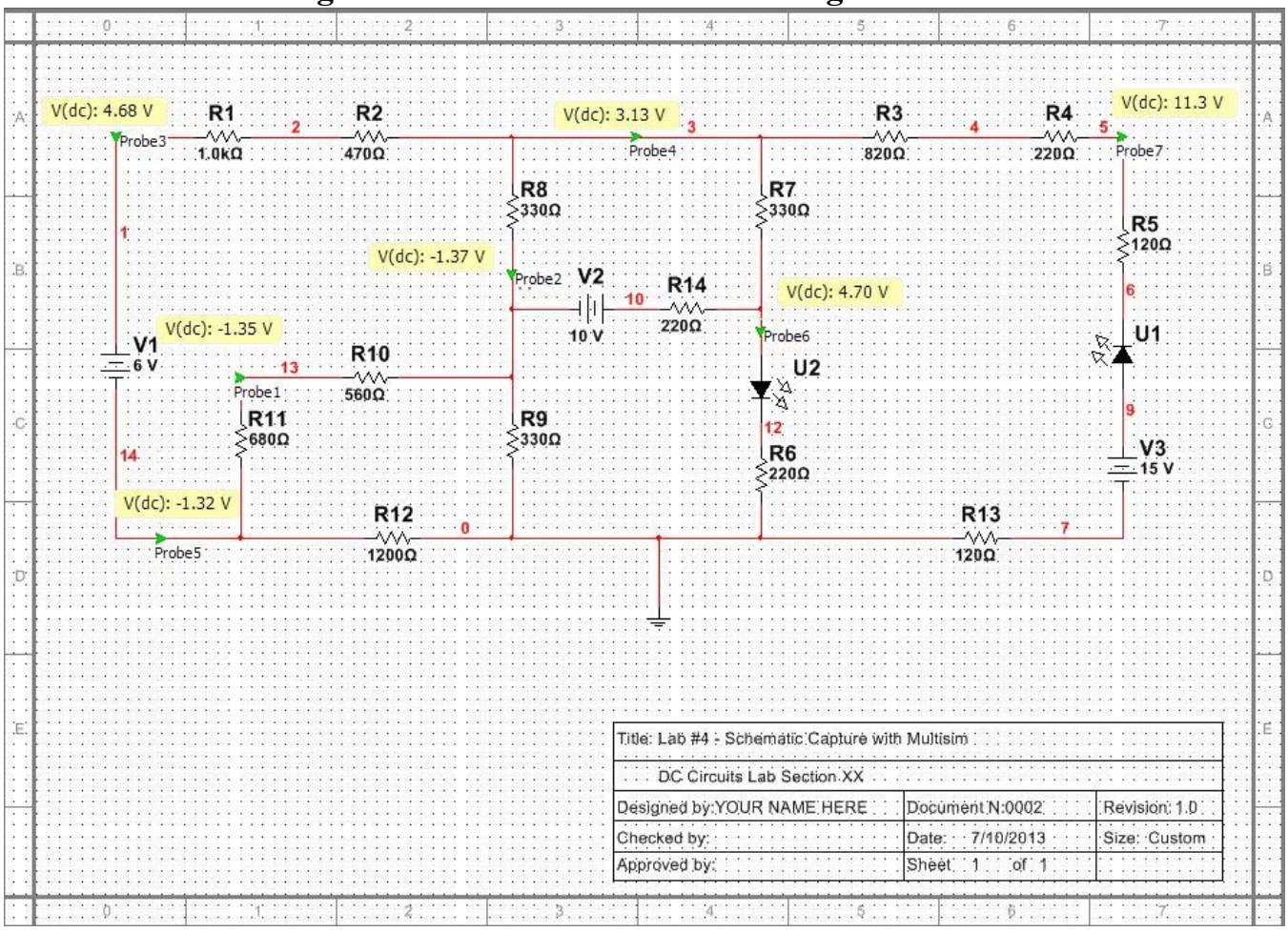
PART 2 – Schematic Entry and Circuit Analysis using Voltage Probes (individual work)

1. Save your design from PART 1 using a different filename.
2. Change your title block to reflect document number N:0002 instead of N:0001.
3. Using the technique shown in Video 2 of the prelab, add DC Voltage Probes as shown in Figure 2.
   a. **Only place the probes on the nodes shown.**
   b. **Position the probes so they do not block or interfere with other circuit elements as much as possible.**
4. Simulate your circuit and verify that your node voltages are correct.
   a. PRINT your resultant schematic showing the node voltages
   b. Have your lab instructor review and sign your team cover page under Part 2, your name. **This is an individual sign-off.**
5. Using your printed schematic from this part of the lab with the probe voltages shown, manually add the following:

   a. The direction of conventional current flow in each branch of the circuit as indicated by a closed arrow (→).
   b. The voltage drop across each resistor with a plus (+) and minus (-) sign. The polarity must reflect the voltage across the component as a result of the current flowing through that component; *use passive sign convention.*

Figure 2 - Schematic with DC Voltage Probes



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Post Lab Requirements

After lab and **during a time specified by your lab instructor**, take the post-lab quiz. You may use your prelab, lab work and data as reference.

Submit your completed documentation at the beginning of next week's lab before you take that week's prelab quiz. Your team's submission package will be graded and returned with comments. Submit only the following (stapled together and in the following order):

1. Your grading cover sheet, completely filled in with signatures, one per team.
2. The schematic from PART 2 of the lab with probe voltages shown AND the hand annotations for current directions and voltage drops, one per team.
3. A table generated using Microsoft Excel that lists:
   - The resistors (by reference designator i.e R1, R2, etc.) clearly showing: the value of each resistor, the voltage across that resistor, the current through it and the power dissipated by it
   - The LEDS, the voltage across and current through each and the power dissipated by each.
   - The voltage sources, the voltage across and current through each as well as the power supplied by each source.

   Your table should be neat, easy to interpret, well sized, and labeled, and include the circuit schematic on the same page (use the Windows snip tool). Sum the power dissipated and power supplied in your table to help answer the question posed below. Hand drawn tables will not be accepted. One per team.
4. On the same page as the data table, answer the following question: Does the total power supplied by the three voltage sources equal the total power absorbed by all of the resistors and LEDS combined? Explain. Use the results from your table to justify your answer to this question. One per team.

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Team Name and Lab Section: .....

Team Members Present (printed)

First Name, Last Name	Role This Lab	RIT Program	Part 1 Sig	Part 2 Sig

TEAM LABORATORY GRADE

(all work done neatly, legible, complete and organized including the schematic from part II with probe data and annotations, all signoffs in place, no missing or extraneous information)

Laboratory Results (all work done neatly, legible, complete and organized including the schematic from part II with probe data and annotations, all signoffs in place, no missing or extraneous information)

/30

(5) Part 1 Signature
(5) Part 2 Signature
(20) Schematic from part 2 (showing I, V annotations)

Post Lab Work and Question (Microsoft Excel data table and questions restated and answered, complete explanations, schematic included, all labeled and organized)

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(15) Data Table (correct values, units, formatting, etc.)
(5) Schematic included and accurate/complete
(10) Question restated, accurate, thoughtful and complete answer

Final Team Grade.....

/60

Instructor comments: