Signature

Name (print, please)

Student No.

ECE 2300 Circuit Analysis
Summer 2009

Quiz 1

DO NOT OPEN THIS QUIZ BOOKLET UNTIL INSTRUCTED TO DO SO

This quiz has 4 pages including this cover page. If you are missing any pages, raise your hand. You have 25 minutes to complete the quiz.

Notes

1. Be sure your name and signature appear above.
2. The quiz is closed-book. You may have a calculator and one 8 ½ " x 11" crib sheet.
3. To receive full credit for a problem, you must:

- Show all work necessary to solve the problem;
- Define all variables and parameters and label them on circuit diagrams;
- Use the proper notation for all variables.
- Show all units explicitly in intermediate and final results;
- Indicate clearly whether power being calculated is absorbed or delivered;

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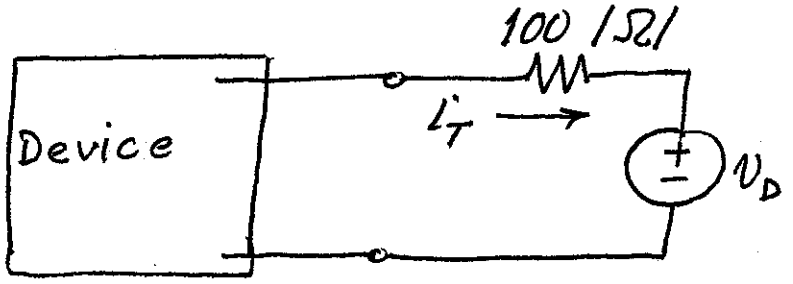
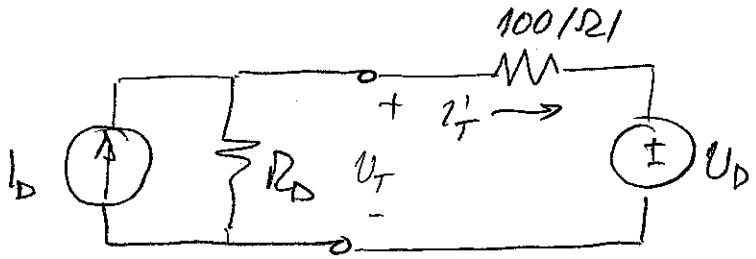
The device in the box can be modeled using a current source in parallel with a resistor. When the voltage source v_D is set to 1 /V/, the current i_T is 0.013 /A/. When v_D is set to - 5 /V/, i_T is - 0.047 /A/. Find the values of the current source and resistor used to model the device D.



We begin by drawing the model of the device and connecting it to the circuit shown:



KCL applied at the top node gives

$$-I_D + \frac{v_T}{R_D} + i_T' = 0$$

we are given i_T' but v_T can easily be found if we know i_T':

KVL $\Rightarrow$ $v_T = 100 i_T' + v_D$. Hence

$$-I_D + \frac{100\, i_T' + v_D}{R_D} + i_T' = 0.$$

Room for Extra Work

We can now proceed to set up 2 equations in 2 unknowns:

$$V_D = 1\,|V| \Rightarrow i_T' = 0.013\,|A| \quad \text{So}$$

$$-I_D + \frac{1.3+1}{R_D} + 0.013 = 0 \qquad (1)$$

$$V_D = -5\,|V| \Rightarrow i_T' = -0.047\,|A| \quad \text{So}$$

$$-I_D + \frac{-4.7-5}{R_D} - 0.047 = 0 \qquad (2)$$

From (2), $I_D = \frac{-9.7}{R_D} - 0.047$

Thus from (1),

$$\frac{9.7}{R_D} + 0.047 + \frac{2.3}{R_D} + 0.013 = 0$$

$$\frac{12}{R_D} + 0.06 = 0 \Rightarrow R_D = -200\,|\Omega|$$

$$\Rightarrow I_D = 1.5\,|mA|$$