Name: _____ (please print)

Signature: _____

ECE 2202 Quiz 1
September 15, 2020
Online

1. This quiz is open book, open notes.
2. 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.
3. Show all units in solutions, intermediate results, and figures. Units in the quiz will be included between square brackets.
4. If the grader has difficulty following your work because it is messy or disorganized, you will lose credit.
5. Do not use red ink. Do not use red pencil.
6. You will have 30 minutes to work on this quiz, and 15 minutes to download/print, scan and submit.

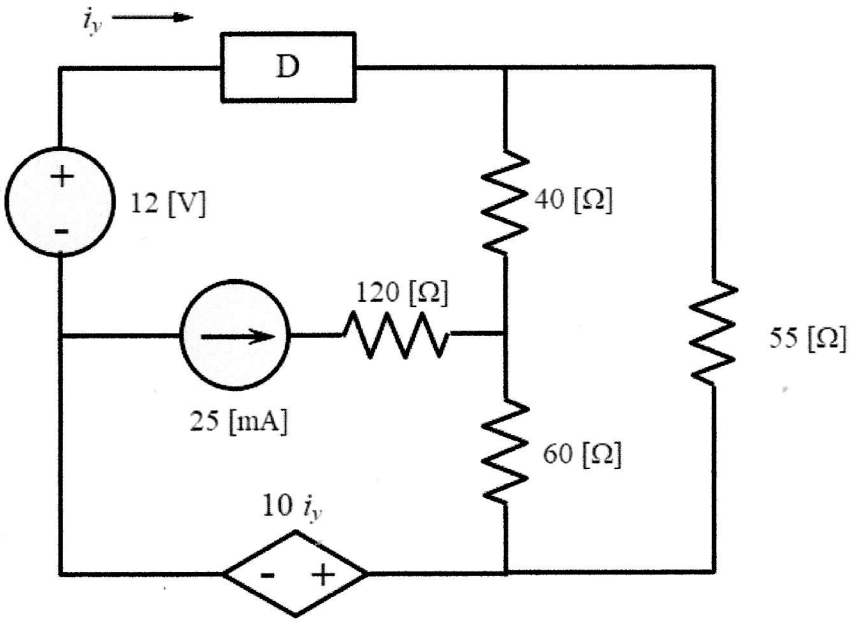
_____/25

Room for extra work

A device D is connected into the circuit as shown. What is inside device D is not known.

a) Find the Thevenin equivalent of the circuit as seen by device D. Include a diagram showing your equivalent circuit with terminals clearly labeled on both the original circuit and the equivalent circuit diagram.

b) If the current i_y is 100 [mA], find the power absorbed by device D.

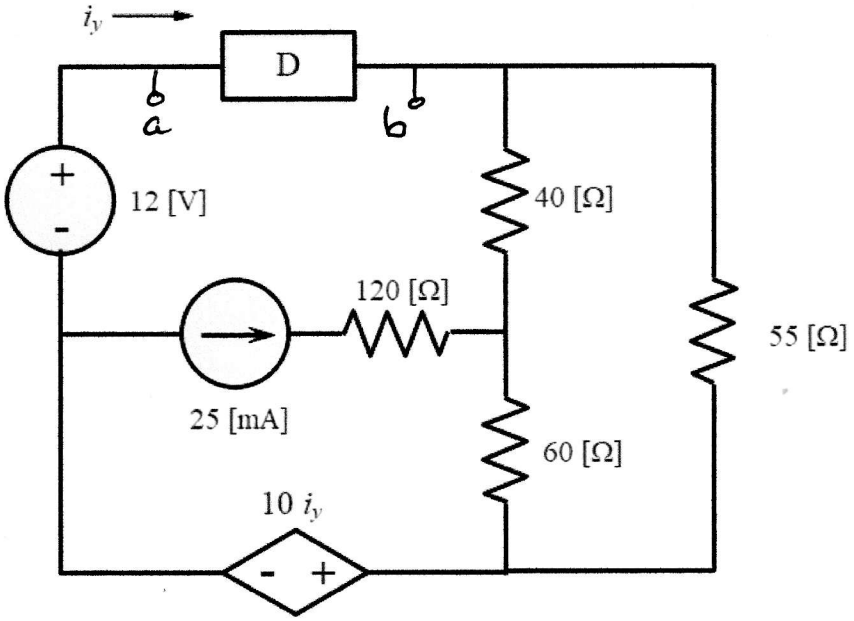


Room for extra work

A device D is connected into the circuit as shown. What is inside device D is not known.

a) Find the Thevenin equivalent of the circuit as seen by device D. Include a diagram showing your equivalent circuit with terminals clearly labeled on both the original circuit and the equivalent circuit diagram.

b) If the current i_y is 100 [mA], find the power absorbed by device D.



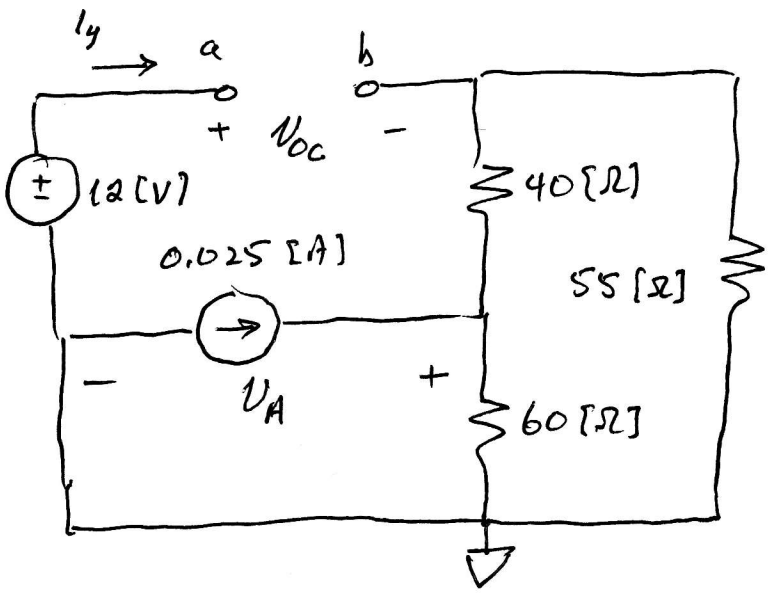
We will need two of short-circuit current, open-circuit voltage, and R_{TH} via test source. For this solution we will do all three.

Note that finding V_{oc} causes i_y to be 0, and simplifies the circuit by removing a mesh. Using a test source simplifies by removing the independent sources. Find i_{sc} is the most difficult.

We have labeled terminals a, b. This is essential for getting the polarity of V_{TH}.

Room for extra work

V_{OC}:



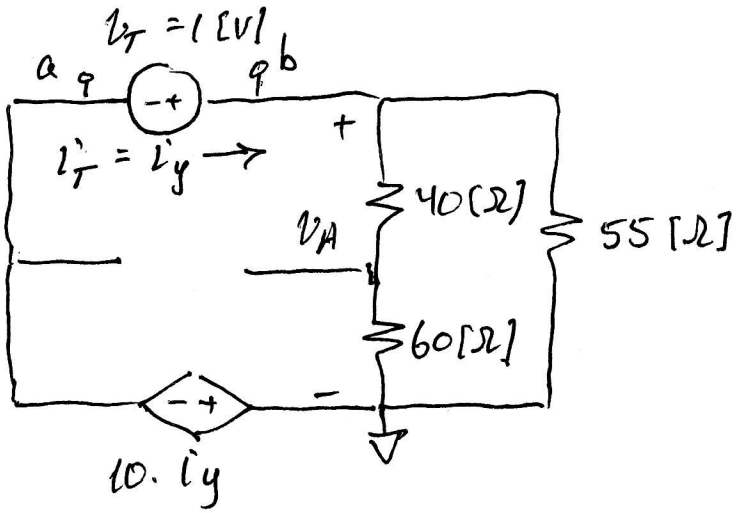
$i_y' = 0$

we have ignored the 120 [Ω] resistor b/c it is in series w/ a current source.

$$-0.025 + \frac{V_A}{60} + \frac{V_A}{95} = 0 \qquad V_{OC} - \frac{V_A}{95}\cdot 40 + V_A - 12 = 0$$

$$V_A = 0.91935 \text{ [V]} \qquad \underline{V_{OC} = V_{TH} = 11.468 \text{ [V]}}$$

R_{TH}:



$$V_A = 1 - 10 \cdot i_y \qquad -i_y + \frac{V_A}{100} + \frac{V_A}{55} = 0$$

$$V_A = 0.78014 \text{ [V]} \qquad i_y = 0.021986 \text{ [A]} = i_T'$$

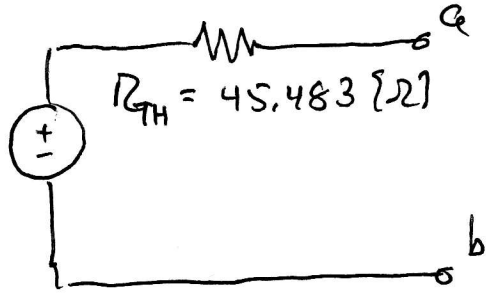
12.2

Room for extra work

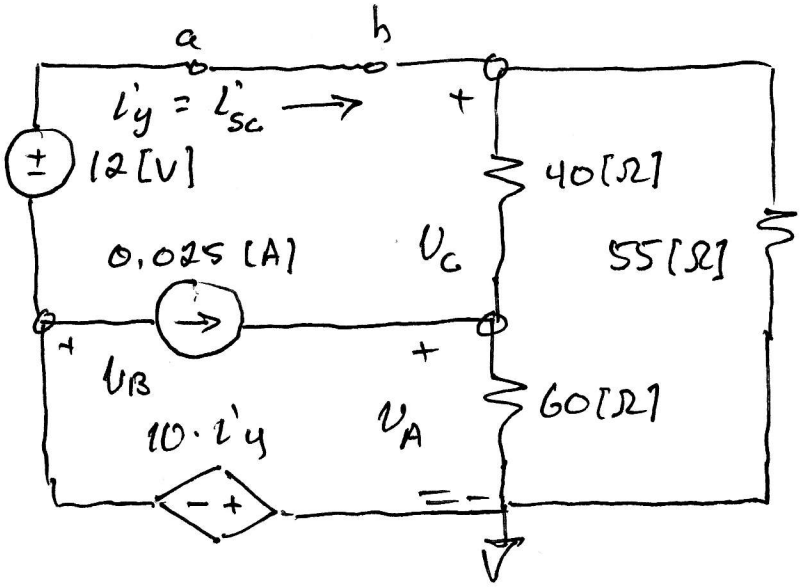
$$i'_T = 0.021986\,[A] \Rightarrow R_{TH} = \frac{1}{i'_T} = 45.483\,[\Omega]$$

We now have our Thevenin equivalent:

a)



We'll find i'_{sc} as well:



As we predicted, this is considerably harder than V_{oc} & V_T/i'_T.

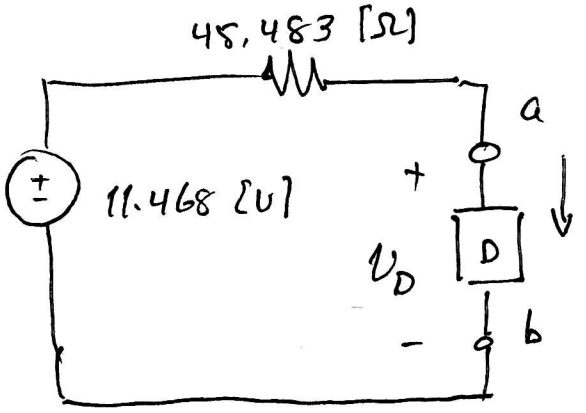
$$V_B = -10 i'_y \qquad -0.025 + \frac{V_A}{60} + \frac{V_A - V_C}{40} = 0$$

$$V_C = 12 - 10 i'_y \qquad -i'_y + \frac{V_C - V_A}{40} + \frac{V_C}{55} = 0$$

$$V_A = 6.2872\,[V] \qquad V_B = -2.5213\,[V] \qquad V_C = 9.4787\,[V]$$

$$i'_y = i'_{sc} = 0.25213\,[A] \qquad 2 \qquad R_{TH} = \frac{V_{oc}}{i'_{sc}} = \frac{11.468}{0.25213} = 45.484\,[\Omega]$$

b)



$$v_D = 11.468 - 0.1(45.483) = 6.9197 \text{ [V]}$$

$$P_{abs\ by\ D} = i'_y \cdot v_D = 0.69197 \text{ [W]}$$