Lab 2 Pre-lab

Due Date : 14/10/2019, 12:30
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Group : (e.g. Monday 14:00, 5)
Subject: Thevenin Equivalent and Maximum Power Transfer

Pre-lab Procedure:

- ➔ Each student must prepare and upload the pre-lab INDIVIDUALLY!
- ➔ Upload as a .PDF file.

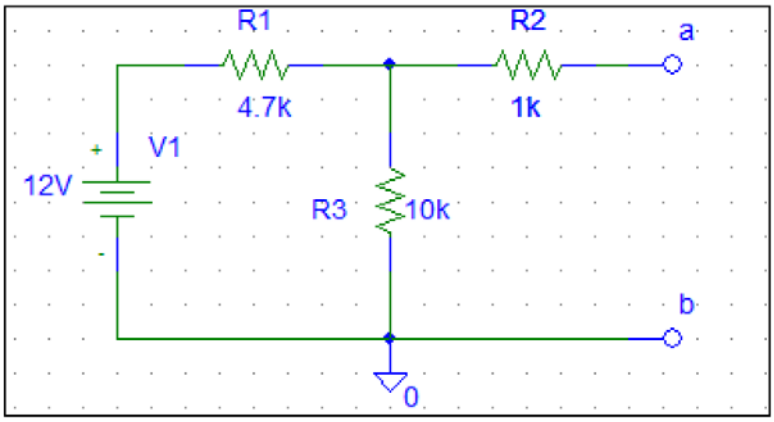
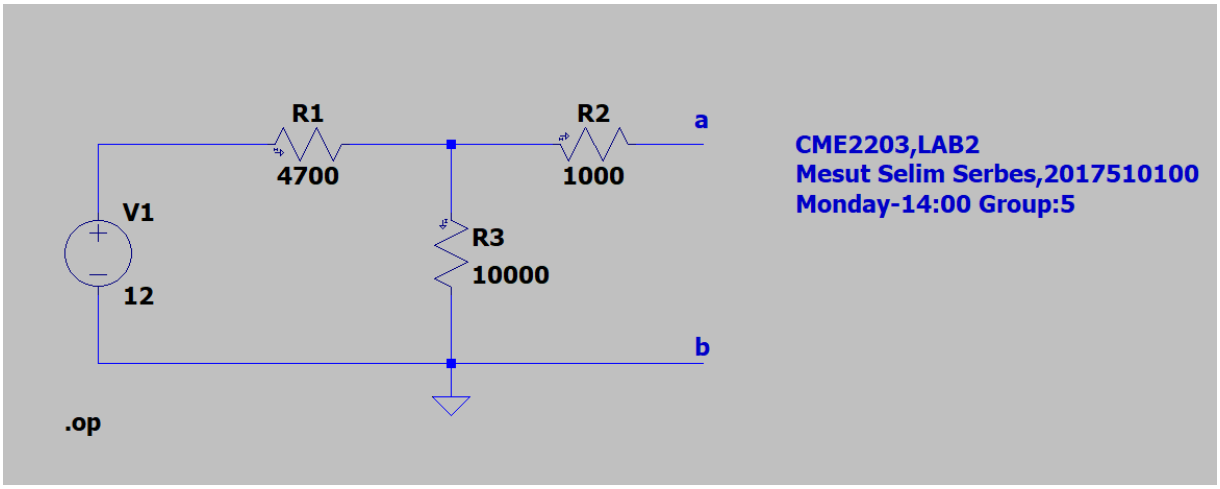


Figure 1

1. Which colors represent the resistors used in the circuit? (ex. Violet, Yellow, Brown) Ignore the tolerances for now.
   a. 4.7KΩ : Yellow, Violet, Red
   b. 1KΩ : Brown, Black, Red
   c. 10KΩ : Brown,Black, Orange
2. Draw the schematic for the circuit in Figure 1 using LTSpice and simulate it.



Also, remember to label the points a and b. Save your schematic. Run a DC operation analysis and note the open circuit voltage across a and b (You should determine the node that corresponds to a-b in the circuit). V_{oc} = 8.16327V.

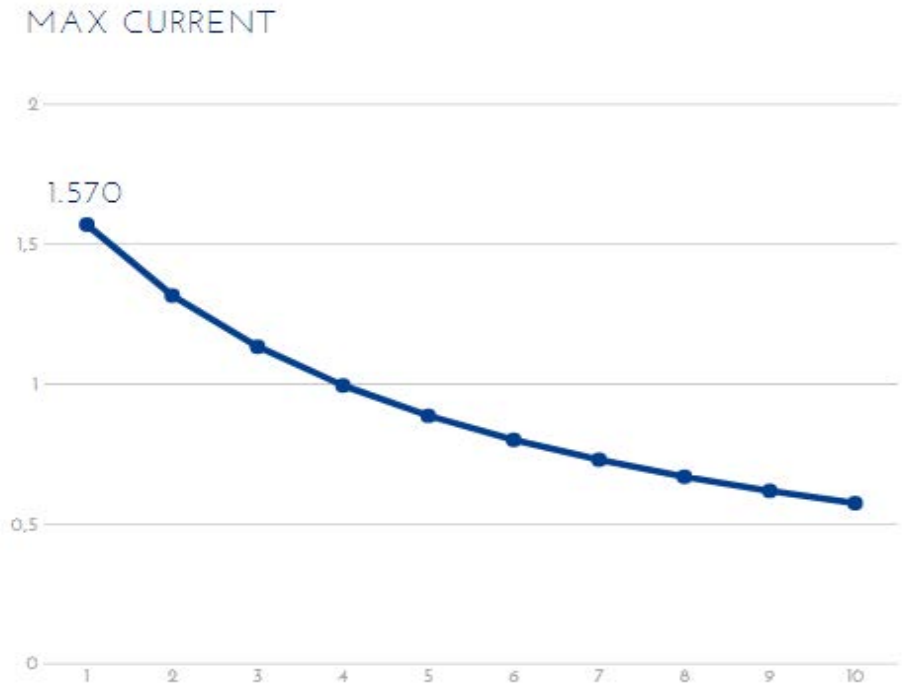
3. Now, connect the points a and b with a wire. Note that now R2 has some current flowing through it and it's the same current flowing through a-b, so $I_{ab}=I_{sc}=I_2=$ 1.94489 mA.
4. We have everything we need to calculate the Thevenin Resistance of the circuit because $R_{Th}=V_{oc}/I_{sc}$=8.16327/1.94489 m=4.19729136KΩ

(Interesting: if we wanted to find the equivalent resistance in the circuit, we have R1||R3+R2 = [R1R3/(R1+R3)]+R2 =4.19727891KΩ).

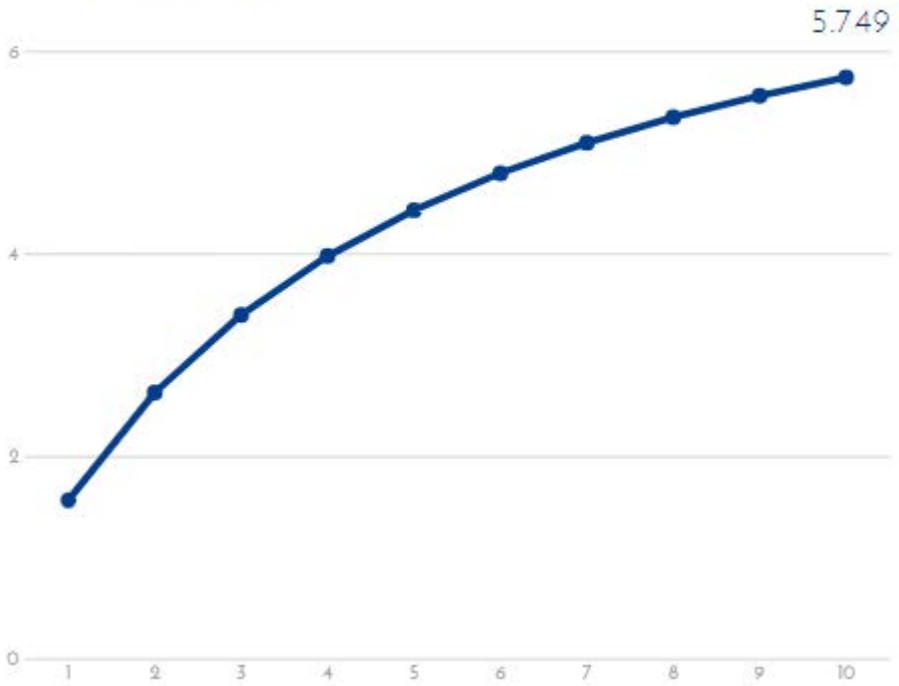
5. Replace the wire between a and b with a 1KΩ resistor and name it R_{load}. Run a DC operation analysis. Use this result to fill in the table below up to 3 decimal digits (ex. 1.227). You should change the resistor value to fill values for each row. Note that I_{ab} = I_{load} and V_{ab} corresponds to the node at the top of R_{load}. Then use your calculator to find the power at R_{load} by multiplying I_{ab} and V_{ab} and fill in the table values.

Load	Iab (mA)	Vab (V)	Pab=IabxVab (mW)
1KΩ	1.570	1.570	2.464
2KΩ	1.317	2.634	3.468
3KΩ	1.134	3.402	3.857
4KΩ	0.995	3.983	3.963
5KΩ	0.887	4.437	3.935
6KΩ	0.800	4.803	3.842
7KΩ	0.729	5.103	3.720
8KΩ	0.669	5.354	3.581
9KΩ	0.618	5.567	3.440
10KΩ	0.574	5.749	3.299

6. Draw current, voltage and power values for each step of R_{load}. You can use MS Excel or MATLAB/Octave but you must include the graph in this document. When is the power maximum?



MAX VOLTAGE



MAX POWER