EPITA / InfoS1 October 2024

NAME : …… First Name : …… Group : ……

Exam Electronics

DC circuit bases: Definitions, Laws and Theorems [SI-S1-ELEC-1-OAC]

Calculators and documents are forbidden. Scoring scale is given as a guide

Answers exclusively on the subject. JUSTIFY YOUR ANSWERS If you need more space, you can use the back of the pages.

Exercise 1. Lecture Questions (2,5 points – no negative point)

Choose the right answer :

Q1. What is electrical current?

a- A potential difference

b- An orderly displacement of electrical charges

c- A displacement of electrical charges

d- A heat dissipation

Q2. A branch in an electrical circuit is:

a- A part of a circuit including a single generator

b- A wire between 2 components

c- A part of a circuit including a single resistor

d- A part of a circuit between two consecutive nodes

Q3. What is the unit for an electrical voltage?

a- Watts (W)

b- Amperes (A)

c- Ohms (Ω)

d- Omh times Ampere ($\Omega . A$)

Q4. The intensity of the current that enters a resistance is greater than the intensity of the current that comes out

a- TRUE

b- FALSE

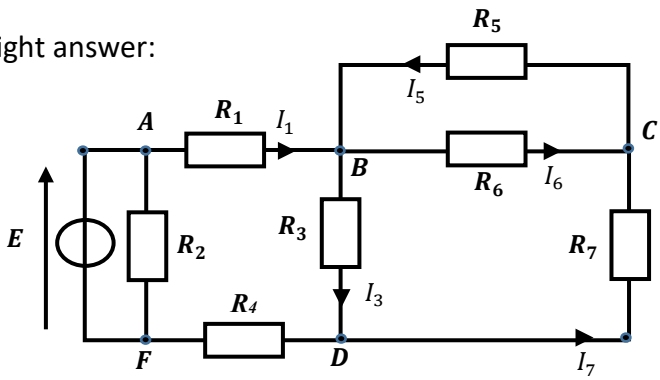
Q5. Consider the diagram on the right. Choose the right answer:

a- R_1 and R_2 are in series

b- R_2 and R_3 are in parallel

c- R_3 and R_7 are in parallel

d- R_5 and R_6 are in parallel

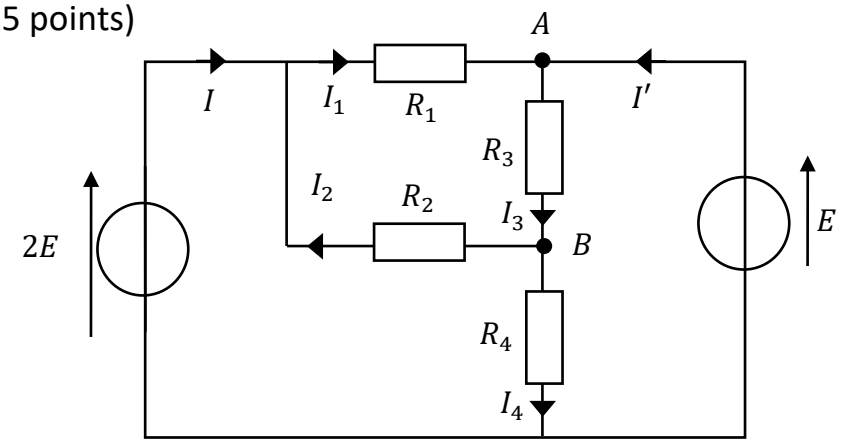


Exercise 2. Fundamental Laws (6,5 points)

Consider the diagram on the right.

We set:

$E = 6V$, $U_{AB} = V_A - V_B = 4V$
$I_1 = 10mA$, $I_3 = 2mA$, $I_4 = 7mA$
$R_2 = 2k\Omega$.



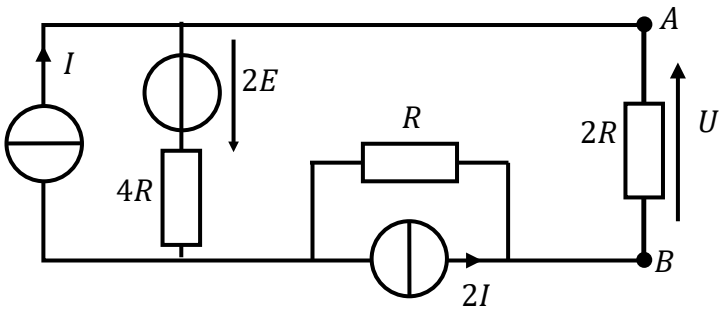
1. On this diagram, find the number of:
   a. Nodes? b. Branches? c. Loops?
2. Draw the various voltages on the diagram using sign conventions. Note U_i for the voltage between the terminals of resistorR_i (i.e. $U_1 =$ voltage between the terminals of resistor R_1, $U_2 =$ Voltage between the terminals of resistor R_2…)
3. What is the value of the resistor R_3 ?

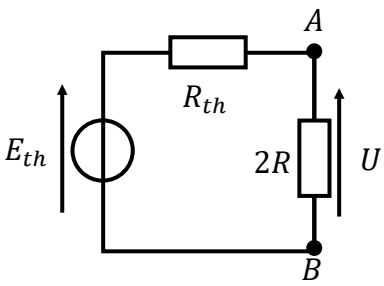
4. Calculate the intensity of the current flowing trough R_2. Deduce the voltage between the terminals of resistor R_2.

5. Establish the expression of voltage U_4 between R_4 terminals then, calculate it.

Exercise 3. Thévenin/Norton equivalents (11 points)

1. Consider the two diagrams below.

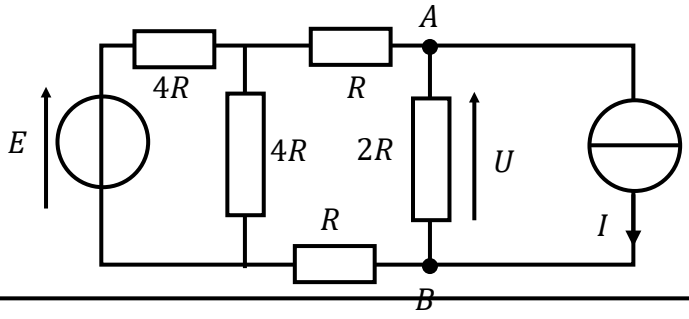




a. Set the expressions of E_{th} and R_{th} - justifying your answers with intermediate diagrams – so as the 2 diagrams above are equivalents.

b. Deduce the expression of the voltage U between the terminals of resistor $2R$ in terms of E, I and R.

2. Consider the diagram on the right. Calculate the voltage U in terms of E, I and R. You can use Thévenin/Norton equivalents. Justify your answer.




Marc Lagneau