Universidad Nacional Autónoma de México

Facultad de Ingeniería

División de Ingeniería Eléctrica

Análisis de Circuitos

Semestre 2021-1

Grupo: 7

Serie 1 de Ejercicios

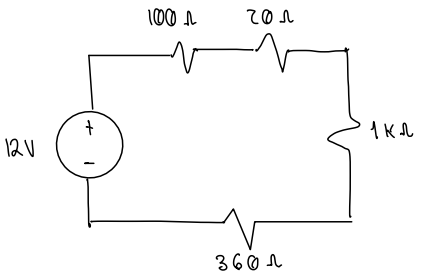
Celaya González David Alejandro
Hernández García Aarón

Profesora: JULIA VAZQUEZ FUENTES

Fecha de Entrega 11 de noviembre de 2020

(1)

Del siguiente circuito obtener a) Resistencia equivalente b) Corriente c) Voltaje d) Potencia de la fuente y del circuito cada uno de los resistores.



Resistencia	Voltaje [V]	Corriente [mA]	Potencia [mW]
100 Ω	0.8108	8.1081	6.5741
20 Ω	0.1622	8.1081	1.3151
1 kΩ	8.1081	8.1081	65.7414
360 Ω	2.9189	8.1081	20.6668
Req	12	8.1081	97.2973

$Req = (100 + 20 + 1000 + 360)[\Omega]$

$Req = 1480\ \Omega$

En un circuito en serie la corriente es la misma

$V = RI$

$P = VI$

$I = V/R = (12V)/(1480[\Omega]) = 8.1081[mA]$

$V_1 = (100\Omega)(8.1081\ mA) = 0.8108$

$V_2 = (20\Omega)(8.1081\ mA) = 0.1622$

$V_3 = (1K\Omega)(8.1081\ mA) = 8.1081$

$V_4 = (360)(8.1081\ mA) = 2.9189$

$P_1 = 6.5741\ [mW]$

$P_2 = 1.3151\ [mW]$

$P_3 = 65.7414\ [mW]$

$P_4 = 20.6668\ [mW]$

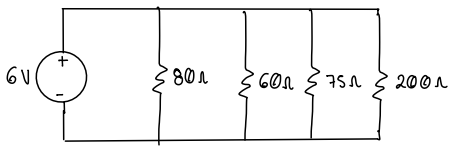
(2)

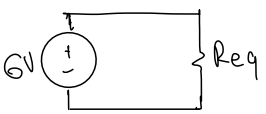
RESISTENCIA	VOLTAJE [V]	CORRIENTE [A]	POTENCIA [W]
80 Ω	6	0.075	0.45
60 Ω	6	0.1	0.6
75 Ω	6	0.08	0.48
200 Ω	6	0.03	0.18
Req = 21.0523	6	0.2850	1.71

a) Resistencia equivalente
b) Corriente
c) Voltaje
d) Potencia

$$Req = \left(\frac{1}{80} + \frac{1}{60} + \frac{1}{75} + \frac{1}{200}\right)^{-1}$$

$Req = 21.0523[\Omega]$





$I = V/R = 6/21.0523 = 0.2850[A]$

$I_1 = 6/80 = 0.075$

$I_2 = 6/60 = 0.1$

$I_3 = 6/75 = 0.08$

$I_4 = 6/200 = 0.03$

POTENCIA $(P = VI)$

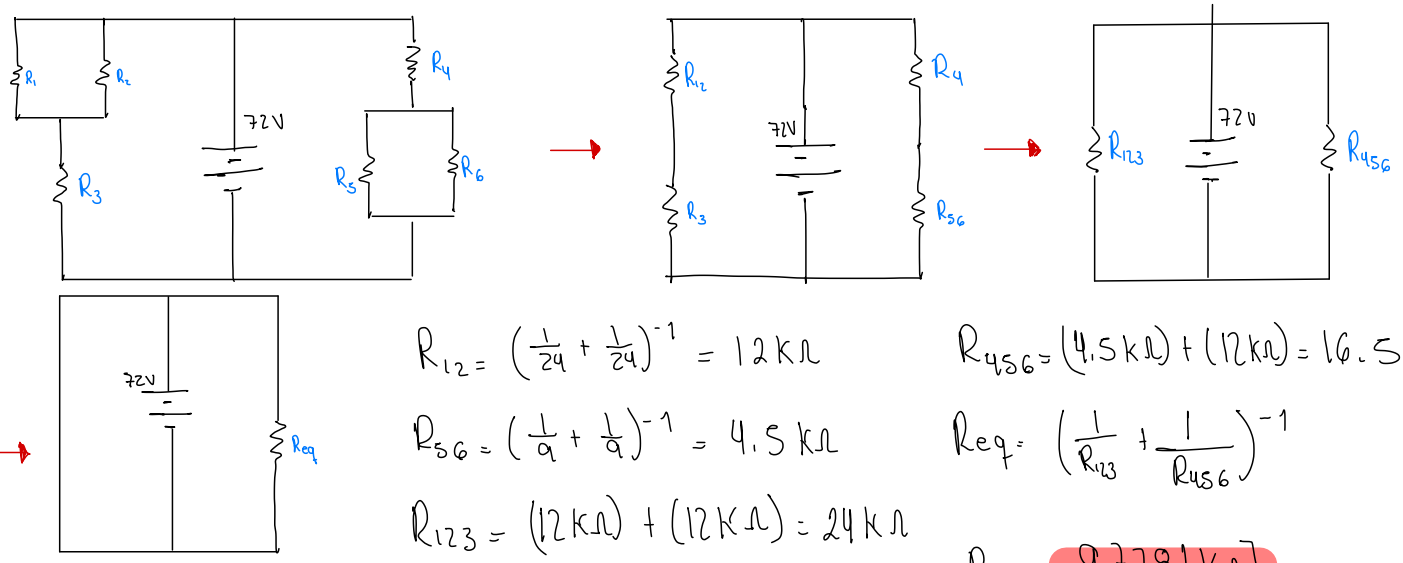
$P_1 = (6V)(0.075\ A) = 0.45\ [W]$

$P_2 = (6V)(0.1) = 0.6\ [W]$

$P_3 = (6V)(0.08) = 0.48\ [W]$

$P_4 = (6V)(0.03) = 0.18\ [W]$

3) Obtener a) Resistencia equivalente b) Voltaje c) Corriente d) Potencias



$R_{12} = \left(\frac{1}{24} + \frac{1}{24}\right)^{-1} = 12\,k\Omega$

$R_{56} = \left(\frac{1}{9} + \frac{1}{9}\right)^{-1} = 4.5\,k\Omega$

$R_{123} = (12k\Omega) + (12k\Omega) = 24\,k\Omega$

$R_{456} = (4.5\,k\Omega) + (12k\Omega) = 16.5\,[k\Omega]$

$R_{eq} = \left(\frac{1}{R_{123}} + \frac{1}{R_{456}}\right)^{-1}$

$R_{eq} = 9.7781\,[k\Omega]$

$R_1 = 24\,k\Omega$
$R_2 = 24\,k\Omega$
$R_3 = 12\,k\Omega$
$R_4 = 12\,k\Omega$
$R_5 = 9\,k\Omega$
$R_6 = 9\,k\Omega$

$I = (72[V]) / (9.7781[k\Omega]) = 7.3635\,[mA]$

$V_{123} = (72[V])/(24\,k\Omega) = 3\,[mA]$

$V_{456} = (72[V])/(16.5\,k\Omega) = 4.3636\,[mA]$

$V_3 = (12\,k\Omega)(3\,mA) = 36\,[V]$
$V_{12} = (12\,k\Omega)(3\,mA) = 36\,[V]$

$V_4 = (12\,k\Omega)(4.3636\,mA) = 52.3632\,[V]$
$V_{56} = (4.5\,k\Omega)(4.3636\,mA) = 19.6362\,[V]$

$I_1 = (36V)/(24k\Omega) = 1.5\,[mA]$
$I_2 = (36V)/(24k\Omega) = 1.5\,[mA]$

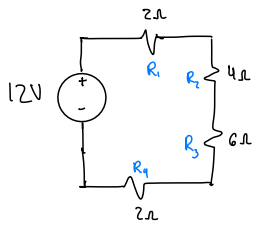
$I_5 = (19.6362[V]) / (9\,k\Omega) = 2.1818\,[mA]$
$I_6 = (19.6362[V])/(9k\Omega) = 2.1818\,[mA]$

$P = VI$

$P_1 = 0.054\,[W]$
$P_2 = 0.054\,[W]$
$P_3 = 0.108\,[W]$
$P_4 = 0.2285\,[W]$
$P_5 = 0.0428\,[W]$
$P_6 = 0.04281\,[W]$
$P_T = 0.5302\,[W]$

RESISTENCIA [kΩ]	VOLTAJE [V]	CORRIENTE [mA]	POTENCIA [W]
24 R_1	36	1.5 [mA]	0.054
24 R_2	36	1.5 [mA]	0.054
12 R_3	36	3	0.108
12 R_4	52.3632	4.3636	0.2285
9 R_5	19.6362	2.1818	0.0428
9 R_6	19.6362	2.1818	0.04281
R_{eq} = 9.778	72	7.3635	0.5302

④ Utilizando divisor de voltaje



$$Req = (R_1 + R_2 + R_3 + R_4) = (2+4+6+2)[\Omega] = 14[\Omega]$$

$$V_1 = \frac{(2\Omega)(12V)}{14\Omega} = 1.7143[V] \qquad V_3 = \frac{(6\Omega)(12V)}{14\Omega} = 5.1429[V]$$

$$V_2 = \frac{(4\Omega)(12V)}{14\Omega} = 3.4286[V] \qquad V_4 = \frac{(2\Omega)(12V)}{14\Omega} = 1.7143[V]$$

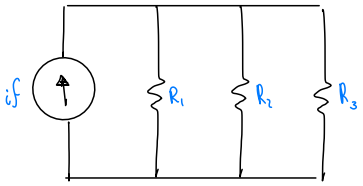
$$I = V/R = (12V)/(14\Omega) = 0.8571[A]$$

Resistencia [Ω]	Voltaje [V]	Corriente [A]	Potencia [W]
$R_1 = 2$	1.7143	0.8571	1.4693
$R_2 = 4$	3.4286	0.8571	2.9387
$R_3 = 6$	5.1429	0.8571	4.4080
$R_4 = 2$	1.7143	0.8571	1.4693
$Req = 14$	12	0.8571	10.2852

$$P = VI$$

$$P_1 = (1.7143\ V)(0.8571A) = 1.4693[W]$$
$$P_2 = (3.4286\ V)(0.8571A) = 2.9387[W]$$
$$P_3 = (5.1429\ V)(0.8571A) = 4.4080[W]$$
$$P_4 = (1.7143\ V)(0.8571A) = 1.4693[W]$$
$$P_T = (12\ V)(0.8571A) = 10.2852[W]$$

⑤ Utilizando el divisor de corriente



$if = 2[A]$
$R_1 = 100\Omega$
$R_2 = 500\Omega$
$R_3 = 1K\Omega$

$$Req = \left(\frac{1}{100} + \frac{1}{500} + \frac{1}{1000}\right)^{-1} = 76.9231[\Omega]$$

$$V = R1 = (76.9231[\Omega])(2A) = 153.8462[V]$$

$$\sum_{i=1}^{3} 1/R_i = \left(\frac{1}{100} + \frac{1}{500} + \frac{1}{1000}\right) = 0.013$$

$$I_1 = \frac{(2A)(1/1000[\Omega])}{0.013[\Omega]} = 1.5385[A]$$

$$I_2 = \frac{(2A)(1/500[\Omega])}{0.013[\Omega]} = 0.3077[A]$$

$$I_3 = \frac{(2A)(1/1000[\Omega])}{(0.013[\Omega])} = 0.1538[A]$$

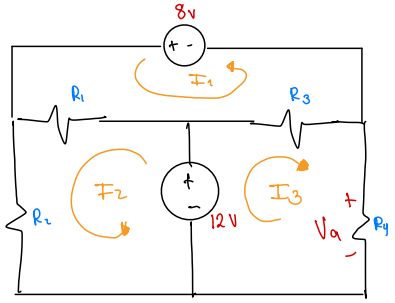
$$V_1 = (100\Omega)(1.5385A) = 153.85[V]$$

$$V_2 = (500\Omega)(0.3077A) = 153.85[V]$$

$$V_3 = (1000\Omega)(0.1581A) = 153.85[V]$$

Resistencia [Ω]	Voltaje [V]	Corriente [A]	Potencia [W]
$R_1 = 100$	153.85	1.5385	236.6982
$R_2 = 500$	153.85	0.3077	47.3396
$R_3 = 1000$	153.85	0.1538	23.6691
$Req = 76.923$	153.85	2	307.7

⑥ Utilizando Método de corriente de Mallas obtener el voltaje a Va



$R_1 = 125\ \Omega$
$R_2 = 500\ \Omega$
$R_3 = 250\ \Omega$
$R_4 = 500\ \Omega$

Malla 1: $\sum V = 0 \Rightarrow \sum V = \sum IR$

$8\,V = (125 + 250)\,\Omega\, I_1 - 125\,\Omega I_2 + 250\,\Omega I_3$

$8\,V = (375\,\Omega)\,I_1 - 125\,\Omega I_2 + 250\,\Omega I_3 \quad \dots ①$

Malla 2: $\sum V = 0 \Rightarrow \sum V = \sum IR$

$12V = (125 + 250)[\Omega]\, I_2 - (125\,\Omega)\, I_1$

$12\,V = 375\,\Omega I_2 - 125\, I_1 \quad \dots ②$

Malla 3:

$12\,V = (250 + 500\,\Omega) I_3 + 250\,\Omega I_1$

$12\,V = 750\,\Omega I_3 + 250\,\Omega I_1 \quad \dots ③$

SIST. EC.

$$375 I_1 - 125 I_2 + 250 I_3 = 8$$
$$-125 I_1 + 375 I_2 + 0 I_3 = 12$$
$$250 I_1 + 0 I_2 + 750 I_3 = 12$$

RESOLVIENDO SIST.

$I_1 = 0.032\,[A]$ $I_2 = 0.0427\,[A]$ $I_3 = 5.33\,[mA]$

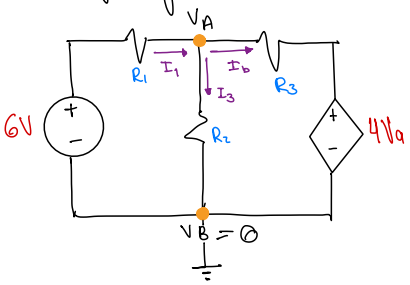
$\Rightarrow$ POR LEY DE OHM

$V = RI$

$V_A = R_4 I_3 = (500\,\Omega)(5.33 \times 10^{-3}\,[A])$

$V_A = 2.665\,[V]$

⑦ Voltajes de Nodos



$R_1 = 1k\Omega$
$R_2 = 2k\Omega$
$R_3 = 3k\Omega$

$\sum I = 0 \Rightarrow \sum I_E = \sum I_S$

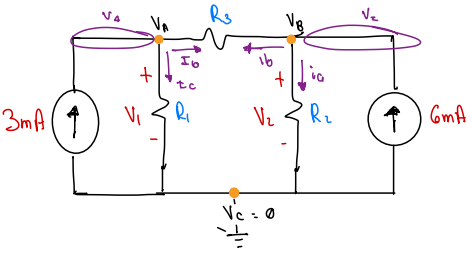
Nodo A: $I = V/R$

$$\frac{6 - V_A}{1} = \frac{V_A - 4V_A}{3} + \frac{V_A - V_B}{2}$$

$$6(6 - V_A) = 2V_A - 8V_A + 3V_A - 3V_B$$
$$36 - 6V_A = -3V_A - 3V_B \quad (V_B = 0)$$
$$3V_A = 36$$
$$V_A = 12$$

$4V_A = 48\,V$

⑧



$V_1 = 1V$
$V_2 = 2V$

$\sum I = 0$

$\sum I_E = \sum I_S$

NODO A:

$$0.003 = \frac{V_A - V_B}{500} + \frac{1}{R_1}$$

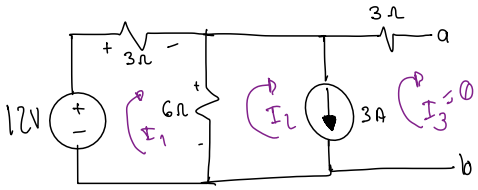
NODO B: $\sum I = 0 \Rightarrow \sum I_E = \sum I_S$

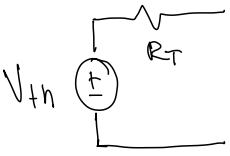
$$0.006 = \frac{2}{R_2} + \frac{V_B - V_A}{500}$$

$$0.003 = -\frac{1}{500} + \frac{1}{R_1}$$

$$0.006 = \frac{1}{500} + \frac{2}{R_2}$$

$R_1 = 200\,[\Omega]$ $R_2 = 500\,\Omega$





$3A = I_2 - I_3^{\nearrow 0}$

$3A = I_2$

Malla 1: $\sum V = 0 \Rightarrow \sum R_1 = 0$

$-12V + 3i_1 + 6(i_1 - i_2) = 0$

$-12V + 3i_1 + 6i_1 - 6i_2 = 0$

$9i_1 - 18 = 12V$

$9i_1 = 30$

$i_1 = 30/9$

$i_1 = 3.333$

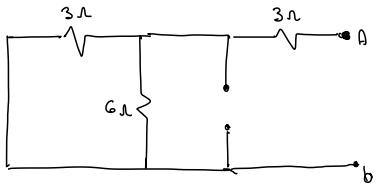
Malla 2

$-6(i_1 - i_2) + 3 \cdot 0 + V_{th} = 0$

$-6i_1 + 6i_2 + V_{th} = 0$

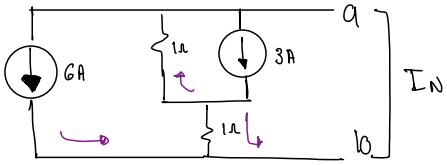
$V_{th} = 2[V]$

$P = \frac{V^2}{R} = \frac{(2)^2}{5} = \frac{4}{5} = 0.8[W]$

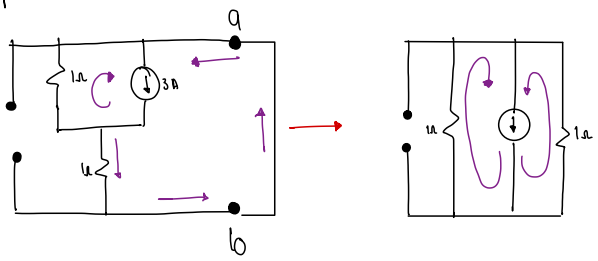


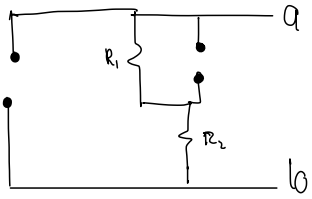
$R_T = \frac{3 \times 6}{3+6} + 3 = 5\Omega$

4) Resolver por Norton y Máxima Transferencia de potencia.



I_N''





$R_N = R_1 + R_2$

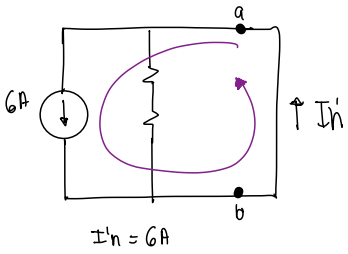
$R_N = 2\Omega$

Aplicando divisor de corriente

$I_N'' = \frac{1\Omega \,||\, 1\Omega}{1\Omega}(3A)$

$I_N'' = \frac{1(1)}{1+1}(3) = \frac{0.5}{1}(3)$

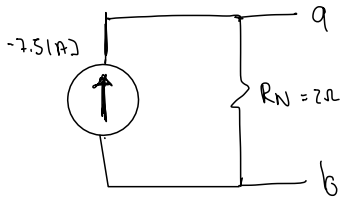
$I_N'' = 1.5[A]$



$\therefore I_n = -I'_n - I''_n$

$I_n = -6 - 1.5$

$I_n = -7.5[A]$



$\Rightarrow P = I^2 R = (-7.5)^2(2) = 112.5[W]$