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412D 13/3/2021
Grupa Data/ora

Fișă laborator 1 - online
rev. 2

ID =61

1.a) Verificarea legii lui Ohm

$$R_{1 \text{ calc}} = 7.1 \text{ K}\Omega \quad R_{1 \text{ ales}} = 6.8 \text{ K}\Omega \quad \text{tol.} = \pm 5 [\%] \quad U_1 = 5 \text{ V} \quad I_1 = 735.29 \mu\text{A}$$

$$R_1 = U_1 / I_1 = 5 / 735.29 \cdot 10^{-6} = 6800.03 \Omega$$

Citire codul culorilor: cifra 1 = 6 cifra 2 = 8 cifra 3 = 2

$$R_{2 \text{ calc}} = 9 \text{ K}\Omega \quad R_{2 \text{ ales}} = 10 \text{ K}\Omega \quad \text{tol.} = \pm 5 [\%] \quad U_2 = 5 \text{ V} \quad I_2 = 500 \mu\text{A}$$

$$R_2 = U_2 / I_2 = 5 / 500 \cdot 10^{-6} = 10.000 \Omega$$

Citire codul culorilor: cifra 1 = 1 cifra 2 = 0 cifra 3 = 3

2a) Divizor de tensiune format cu două rezistențe cu $R_1 = R_2 = 1 \text{ K}$



$$C_Y = 2 \text{ V/div} \quad N_{YA} = 2.5 \text{ div} \quad N_{YB} = 1.25 \text{ div}$$

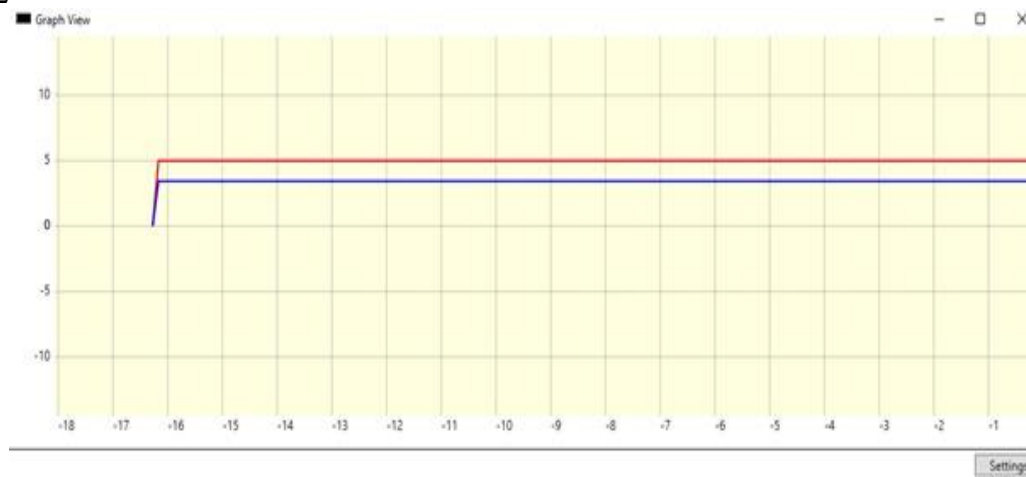
2b) Divizor de tensiune format cu două rezistențe funcție de ID

$$R_{11 \text{ calc}} = 610 \Omega \quad R_{21 \text{ calc}} = 1525 \Omega \quad R_{12 \text{ calc}} = 7.26 \text{ K}\Omega \quad R_{22 \text{ calc}} = 5.75 \text{ K}\Omega$$

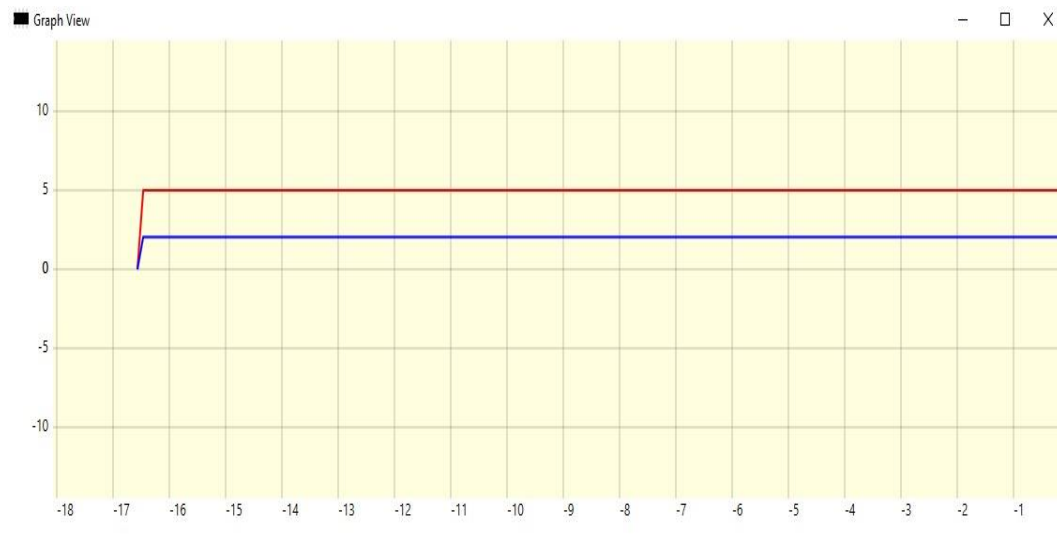
$$R_{11 \text{ ales}} = 680 \Omega \quad R_{21 \text{ ales}} = 1500 \Omega \quad R_{12 \text{ ales}} = 6.8 \text{ K}\Omega \quad R_{22 \text{ ales}} = 4.7 \text{ K}\Omega$$

$$U_{A1} = 5 \text{ V} \quad U_{B1} = 3.44 \text{ V} \quad \frac{U_{B1}}{U_{A1}} = 3.44 / 5 = 0.688 \quad \frac{R_{21}}{R_{11} + R_{21}} = 1500 / 2180 = 0.688$$

$$U_{A2} = 5 \text{ V} \quad U_{B2} = 2.04 \text{ V} \quad \frac{U_{B2}}{U_{A2}} = 2.04 / 5 = 0.408 \quad \frac{R_{22}}{R_{12} + R_{22}} = 4.7 / 11.5 = 0.408$$



(2b, 1)



(2b, 2)

set 1: $C_Y = 5V/div$ $N_{YB} = 0.688div$ set 2: $C_Y = 5V/div$ $N_{YB} = 0.408div$

$$U_B = N_Y C_Y \Rightarrow N_Y = U_B / C_Y = 3.44V / 5V/div = 0.688div \quad (\text{set 1})$$

$$U_B = N_Y C_Y \Rightarrow N_Y = U_B / C_Y = 2.04V / 5V/div = 0.408div \quad (\text{set 2})$$

2c) Divizor de tensiune format cu trei rezistențe

$$R_{1 \text{ calc}} = 7.26 \text{ K}\Omega$$

$$R_{2 \text{ calc}} = 5.75 \text{ K}\Omega$$

$$R_{3 \text{ calc}} = 5.5 \text{ K}\Omega$$

$$R_{1 \text{ ales}} = 6.8 \text{ K}\Omega$$

$$R_{2 \text{ ales}} = 4.7 \text{ K}\Omega$$

$$R_{3 \text{ ales}} = 4.7 \text{ K}\Omega$$

$$R_1: \quad \text{tol} = \pm 5 \quad [\%] \quad \text{cifra 1} = 6 \quad \text{cifra 2} = 8 \quad \text{cifra 3} = 2$$

$$R_2: \quad \text{tol} = \pm 5 \quad [\%] \quad \text{cifra 1} = 4 \quad \text{cifra 2} = 7 \quad \text{cifra 3} = 2$$

$$R_3: \quad \text{tol} = \pm 5 \quad [\%] \quad \text{cifra 1} = 4 \quad \text{cifra 2} = 7 \quad \text{cifra 3} = 2$$

$$U_A = 5V$$

$$U_B = 2.9V$$

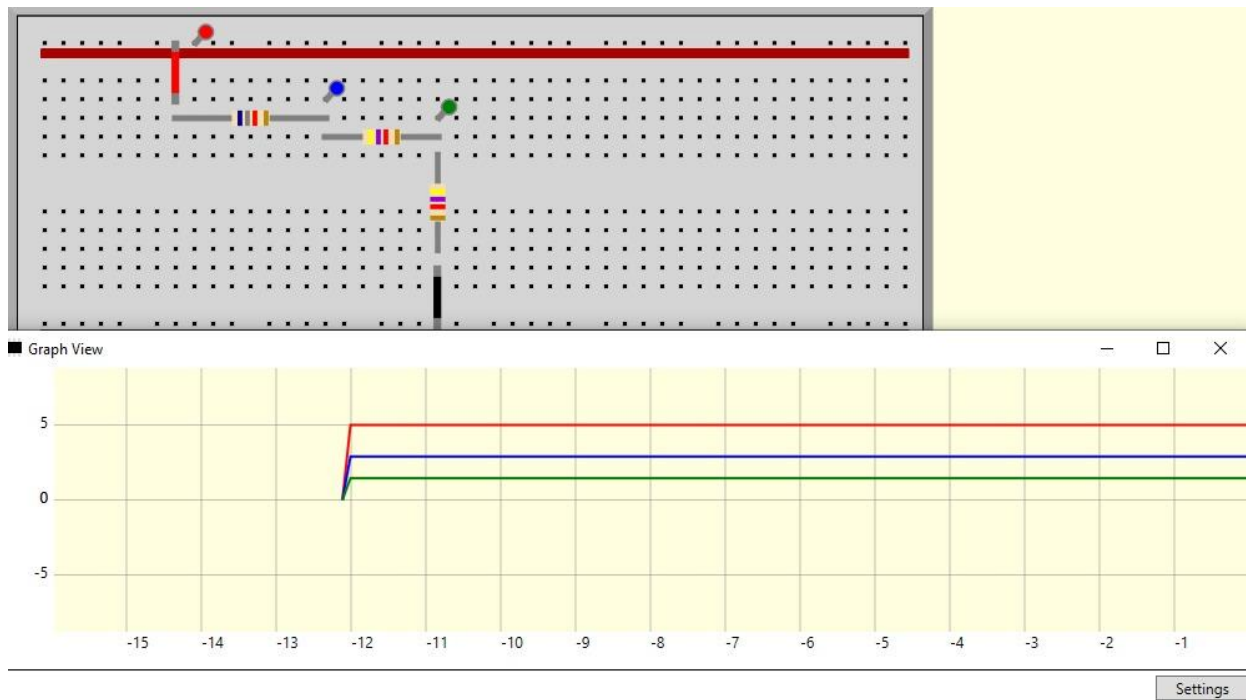
$$U_C = 1.45V$$

$$\left\{ \frac{U_B}{U_A} \right\}_{mas} = 2.9/5 = 0.58$$

$$\left\{ \frac{U_B}{U_A} \right\}_{calc} = (4.7 + 4.7) / (4.7 + 4.7 + 6.8) = 0.5875$$

$$\left\{ \frac{U_2}{U_A} \right\}_{mas} = (U_B - U_C) / U_A = (2.9 - 1.45) / 5 = 0.29$$

$$\left\{ \frac{U_2}{U_A} \right\}_{calc} = 4.7 / (6.8 + 4.7 + 4.7) = 0.2901$$



$$C_Y = 5V/div$$

$$N_{Y A} = U_A / C_Y = 5/5 = 1$$

$$N_{Y B} = U_B / C_Y = 2.9/5 = 0.58$$

$$N_{Y C} = U_C / C_Y = 1.45/5 = 0.29$$

3. Realizarea unor circuite date pe placa de test

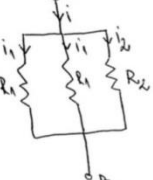
$$R_{1 \text{ calc}} = 6.100\Omega$$

$$R_{1 \text{ ales}} = 6.800\Omega$$

$$R_{2 \text{ calc}} = 15.250\Omega$$

$$R_{2 \text{ ales}} = 15.000\Omega$$

Circuit 1



$$R_p = \frac{R_1}{2} = \frac{6800}{2} = 3400\Omega$$

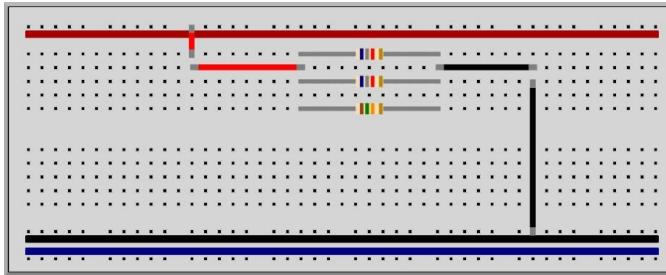
$$R_p = \frac{R_p \cdot R_2}{R_p + R_2} = \frac{3400 \cdot 15000}{3400 + 15000} = \frac{51 \cdot 10^6}{18400} = \frac{510000}{184} = \underline{2771,73\Omega} \quad (R_{AB \text{ calc}})$$

Conform desenului realizat pe breadboard:

$$i = 1803,91\mu A$$

$$R_{AB \text{ mäs}} = \frac{U}{i} = \frac{5}{1803,91 \cdot 10^{-6}} = \frac{5000000}{1803,91} = \underline{2771,75\Omega}$$


Deoarece rezultatele sunt aproximativ egale, rezultatul este corect.



circuit 1 $R_{AB \text{ calc}} = 2771,73\Omega$

$R_{AB \text{ mäs}} = 2771,75\Omega$

Circuit 2



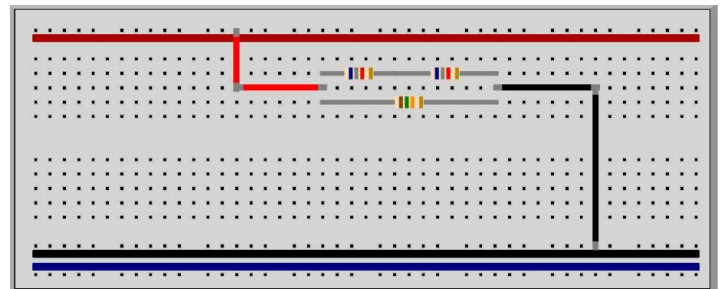
$$R_s = R_1 + R_1 = 13600$$

$$R_p = \frac{R_s \cdot R_2}{R_s + R_2} = \frac{13600 \cdot 15000}{13600 + 15000} = \frac{204 \cdot 10^6}{286 \cdot 10^3} = \underline{7132,86\Omega} \quad (R_{AB \text{ calc}})$$

Conform desenului realizat pe breadboard:

$$i = 700,98\mu A$$


$$R_{AB \text{ mäs}} = \frac{5}{700,98 \cdot 10^{-6}} = \underline{7132,87\Omega}$$



circuit 2 $R_{AB \text{ calc}} = 7132,86\Omega$

$R_{AB \text{ mäs}} = 7132,87\Omega$

Circuitul 3



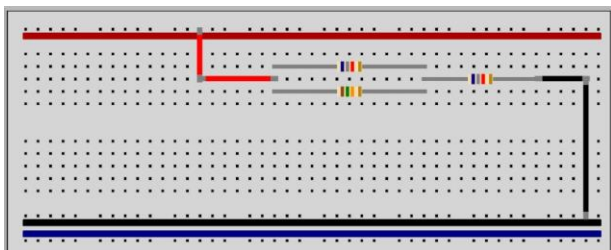
$$R_p = \frac{R_1 R_2}{R_1 + R_2} = \frac{6800 \cdot 15000}{21800} = 4678,89\Omega$$

$$R_{AB \text{ calc}} = R_p + R_1 = 4678,89 + 6800 = \underline{11478,89\Omega}$$

Conform montajului realizat pe breadboard:

$$i = 435,58\mu A$$

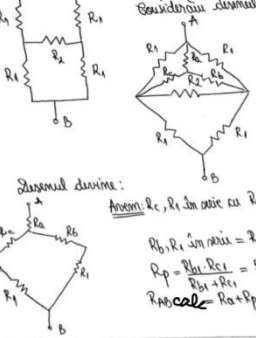
$$R_{AB \text{ mäs}} = \frac{5}{435,58 \cdot 10^{-6}} = \underline{11478,94\Omega}$$



circuit 3 $R_{AB \text{ calc}} = 11478,89\Omega$

$R_{AB \text{ mäs}} = 11478,94\Omega$

Circuit 4



Pentru a calcula rezistența echivalentă folosim transformarea stea-triunghi astfel:

Considerăm desenele astfel:

$$R_a = \frac{R_1 R_2}{R_1 + R_2 + R_3} = \frac{6800 \cdot 6800}{28600} = \frac{46240 \cdot 10^3}{28600} = 1616,78\Omega$$

$$R_b = R_3 = \frac{6800 \cdot 15000}{28600} = 3566,43\Omega$$

Desenul devine:

Avem: R_c, R_1 în serie cu $R_{c1} = R_c + R_1 = 3566,43 + 6800 = 10366,43\Omega$

R_b, R_1 în serie cu $R_{c1} = 10366,43\Omega$

$$R_p = \frac{R_{c1} R_{c1}}{R_{c1} + R_{c1}} = 5183,21\Omega$$

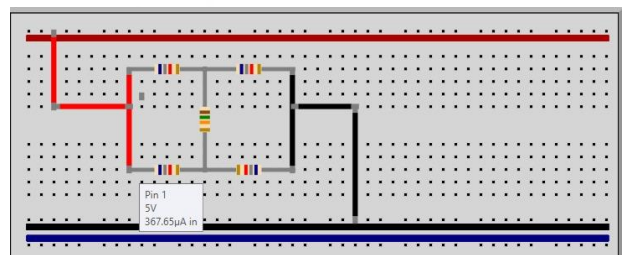
$$R_{AB \text{ calc}} = R_a + R_p = 6799,99\Omega$$

Realizând montajul conform breadboardului:

$$i = 367,65\mu A \text{ (pe o singură latură)}$$

$$i = 435,5\mu A$$

$$R_{AB \text{ mäs}} = \frac{5}{435,5 \cdot 10^{-6}} = \underline{6799,94\Omega}$$



circuit 4 $R_{AB \text{ calc}} = 7132,86\Omega$

$R_{AB \text{ mäs}} = 7132,87\Omega$

4. Proiectarea și realizarea unor circuite rezistive pe placa de test

$$R_{1 \text{ ales}} = 6800 \Omega$$

$$R_{2 \text{ ales}} = 15000 \Omega$$

$$R_{AB \text{ 1 dorit}} = 6100 \Omega$$

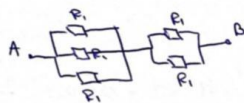
$$R_{AB \text{ 2 dorit}} = 19520 \Omega$$

$$R_{AB \text{ 3 dorit}} = 34160 \Omega$$

schema proiectată:

Circuit 1

$$R_{AB \text{ dorit}} = 61 \cdot 100 = 6100 \Omega$$



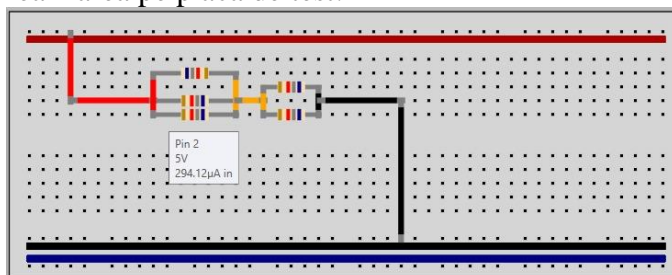
$$R_{AB \text{ obtinut}} = R_p + R_{p2} = \frac{R_1}{3} + \frac{R_2}{2} = \frac{6800}{3} + \frac{15000}{2} = 2266,66 + 7500 = 9766,66 \Omega$$

$$\varepsilon = \frac{9766,66 - 6100}{6100} \cdot 100 = \frac{3666,66}{6100} \cdot 100 = +59,94\%$$

Conform schemei de pe placa de test:

$$R = \frac{5V}{3,294,12 \mu A} = \frac{5V}{32,9412 \mu A} = 15178,89 \Omega$$

realizarea pe placa de test:



circuit 1

$$R_{AB \text{ calc}} = 5666,66 \Omega$$

$$R_{AB \text{ mäs}} = 5666,62 \Omega$$

$$\varepsilon = -7,1\%$$

schema proiectată:

Circuit 3

$$R_{AB \text{ dorit}} = 61 \cdot 560 = 34160 \Omega$$



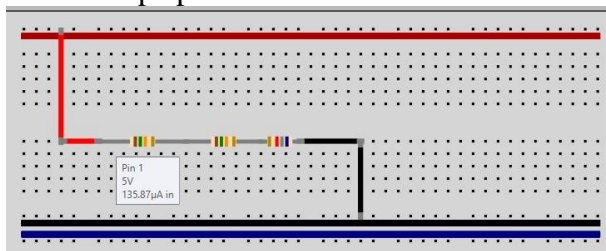
$$R_{AB \text{ obtinut}} = R_1 + R_2 + R_3 = 15000 + 13000 + 6100 = 34100 \Omega$$

$$\varepsilon = \frac{34100 - 34160}{34160} \cdot 100 = -0,17\%$$

Conform schemei de pe placa de test:

$$R = \frac{5V}{125,184 \mu A} = 3993,84 \Omega$$

realizarea pe placa de test:



circuit 3

$$R_{AB \text{ calc}} = 36800 \Omega$$

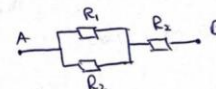
$$R_{AB \text{ mäs}} = 36799,88 \Omega$$

$$\varepsilon = +7,72\%$$

schema proiectată:

Circuit 2

$$R_{AB \text{ dorit}} = 61 \cdot 320 = 19520 \Omega$$



$$R_p = \frac{R_1 R_2}{R_1 + R_2} = \frac{6800 \cdot 15000}{6100 + 15000} = \frac{102000000}{21100} = 4834,12 \Omega$$

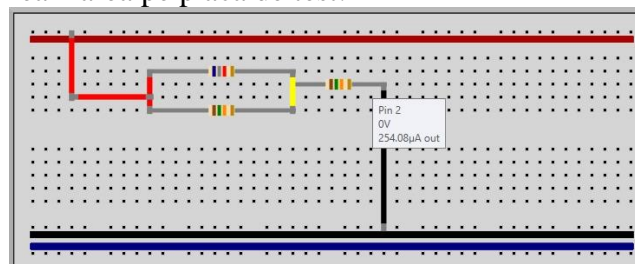
$$R_{AB \text{ obtinut}} = R_p + R_3 = 4834,12 + 15000 = 19834,12 \Omega$$

$$\varepsilon = \frac{19834,12 - 19520}{19520} \cdot 100 = \frac{314,12}{19520} \cdot 100 = +1,61\%$$

Conform schemei de pe placa de test:

$$R = \frac{5V}{254,08 \mu A} = 19678,89 \Omega$$

realizarea pe placa de test:



circuit 2

$$R_{AB \text{ calc}} = 19678,89 \Omega$$

$$R_{AB \text{ mäs}} = 19678,84 \Omega$$

$$\varepsilon = +0,01\%$$

