UNIVERSITE DE RELIZANE
FACULTE DES SCIENCES ET TECHNOLOGIES

Domaine : Sciences et techniques
Année universitaire : 2021 – 2022 **: 2021/2022**
Enseignant :
Module : physique2 **Niveau : 1L(ST)**

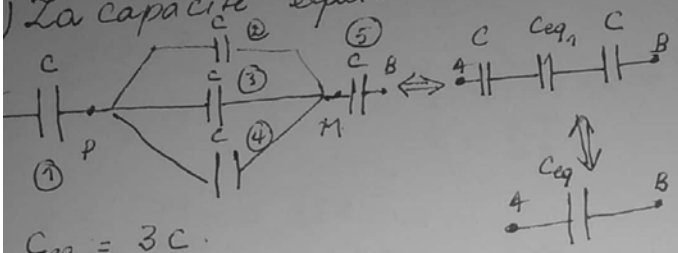
جامعة غليزان
RELIZANE UNIVERSITY

Correction du TD N°03 (*électrostatique*)

EX 01

on donne $C = 2\mu F$

) La capacité équivalente.



$C_{eq_1} = 3C$

$\frac{1}{C_{eq}} = \frac{1}{C} + \frac{1}{3C} + \frac{1}{C}$

$\frac{1}{C_{eq}} = \frac{7}{3C} \Rightarrow C_{eq} = \frac{3}{7}C$

$C_{eq} = \frac{3}{7} \times 2\mu F = 8,57 \times 10^{-5} F$

$C_{eq} = 8,57 \times 10^{-5} F$

) $U_{AB} = 500V$ entre A et B

$V_{AB} = V_{AP} + V_{PM} + V_{MB}$

$\frac{q}{C_{eq}} = \frac{q}{C} + \frac{q}{3C} + \frac{q}{C}$

$U_{AB} = \frac{q}{C_{eq}} \Rightarrow q = U_{AB} \cdot C_{eq}$

$= 500 \times 8,57 \times 10^{-5}$

$q = 4,28 \times 10^{-4} C$

$U_{AP} = \frac{q}{C} = \frac{4,28 \times 10^{-4}}{2 \times 10^{-6}} = 214,28 V$

$U_{PM} = \frac{q}{3C} \Rightarrow \frac{4,28 \times 10^{-4}}{3 \times 2 \times 10^{-6}} = 71,42 V$

$U_{MB} = \frac{q}{C} \Rightarrow \frac{4,28 \times 10^{-4}}{2 \times 10^{-6}} = 214,28 V$

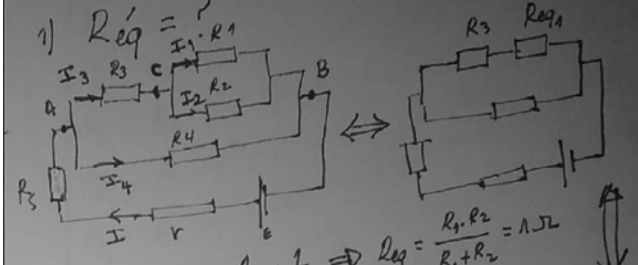
$q = 4,28 \times 10^{-4} C$ (C_1).

$q = 4,28 \times 10^{-4} C$ (C_5).

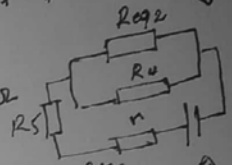
$q = 1,42 \times 10^{-4}$ (C_2, C_3, C_4).

EX02.

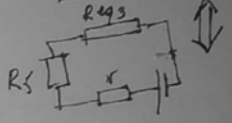
1) $R_{éq} = ?$



$$\frac{1}{Req_1} = \frac{1}{R_1} + \frac{1}{R_2} \Rightarrow Req_1 = \frac{R_1 \cdot R_2}{R_1 + R_2} = 1\,\Omega$$

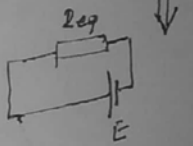


$$Req_2 = R_3 + Req_1 = 3 + 1 = 4\,\Omega$$



$$\frac{1}{Req_3} = \frac{1}{Req_2} + \frac{1}{R_4}$$

$$Req_3 = \frac{Req_2 \cdot R_4}{Req_2 + R_4} = \frac{4 \times 4}{4+4} = 2\,\Omega$$



5) $R_{eq} = Req_3 + R_5 + r$

$= 2 + 6 + 1 = 9\,\Omega.$

$R_{eq} = 9\,\Omega$

2) le courant fourni par la source.

$$E = U_{Req} = Req \cdot I$$

$$I = \frac{E}{Req} = \frac{4,5}{9} = 0,5\,A.$$

3) $I = I_4 + I_3$

$I_3 = I_1 + I_2$

$E = rI + R_5 I + U_{AB} \Rightarrow U_{AB} = E - rI - R_5 I$

$U_{AB} = 4,5 - 1(0,5) - 6(0,5)$

$U_{AB} = 1\,V$

$U_{AB} = R_4 \cdot I_4 \Rightarrow I_4 = \frac{U_{AB}}{R_4} = \frac{1}{4} = 0,25\,A$

$I_3 = I - I_4$

$= 0,5 - 0,25 = 0,25\,A$

$I_3 = I_4 = 0,25\,A$

$U_{AB} = 1\,V$

$U_{AB} = R_3 \cdot I_3 + U_{CB} \Rightarrow U_{CB} = U_{AB} - R_3 I_3$

$U_{CB} = 1 - 3 \times (0,25) = 0,25\,V$

$I_3 = I_1 + I_2 \quad (R_1 = R_2)$

$I_1 = I_2$

$I_3 = 2I_1 \Rightarrow I_1 = I_2 = \frac{I_3}{2} = \frac{0,25}{2}$

$I_2 = I_1 = 0,125\,A$

$$\begin{cases} U_r = r \cdot I = 1 \times 0,5 = 0,5\,V \\ U_{R_5} = R_5 \cdot I = 6 \times 0,5 = 3\,V \\ U_{R_4} = R_4 \cdot I_4 = 4 \times 0,25 = 1\,V \\ U_{R_3} = R_3 \cdot I_3 = 3 \times 0,25 = 0,75\,V \\ U_{R_1} = R_1 \cdot I_1 = 2 \times 0,125 = 0,25\,V \\ U_{R_2} = R_2 \cdot I_2 = 2 \times 0,125 = 0,25\,V \end{cases}$$

4) L'énergie dissepée par chacune.

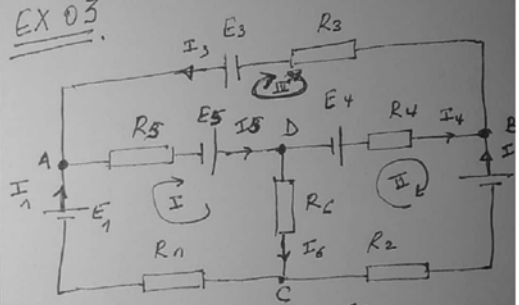
Résistance.

$$\begin{cases} W_{joule} = \boxed{R \cdot I_{eff}^2} \cdot t \\ \text{énergie dissipée par effet joule (joule)} \quad P_{joule} \end{cases}$$

(Ω) (A) (s)

$$P = R I^2 = R \cdot I \cdot I = U \cdot V$$

EX 03



Les lois de Kirchhoff

1ère loi [loi des nœuds]

nœud A :

$$I_5 = I_1 + I_3 \quad \cdots (1)$$

nœud B :

$$I_3 = I_2 + I_4 \quad \cdots (2)$$

nœud C :

$$I_6 = I_2 + I_1 \quad \cdots (3)$$

nœud D :

$$I_5 = I_4 + I_6$$

2ème Loi [loi des mailles]

maille I

$$R_1 I_1 + R_5 I_5 + R_6 I_6 = E_1 + E_5 \quad \cdots (4)$$

maille II

$$R_4 I_4 - R_6 I_6 - R_2 I_2 = E_4 - E_2 \quad \cdots (5)$$

maille III

$$-R_3 I_3 - R_5 I_5 - R_4 I_4 = -E_5 - E_3 - E_4 \quad \cdots (6)$$

on remplace (1), (2) et (3) dans (4), (5) et (6)

$$\begin{cases} 14 I_1 + 10 I_2 + 2 I_3 = 42 \\ -10 I_1 - 16 I_2 + 4 I_3 = -20 \\ -2 I_1 + 4 I_2 - 8 I_3 = -56 \end{cases}$$

$$\Delta = \begin{vmatrix} 14 & 10 & 2 \\ -10 & -16 & 4 \\ -2 & 4 & 8 \end{vmatrix} = \cdots$$

$$I_1 = \frac{\Delta_1}{\Delta} = \frac{\begin{vmatrix} 42 & 10 & 2 \\ -20 & -16 & 4 \\ -56 & 4 & 8 \end{vmatrix}}{\Delta} = -2\,A$$

$$I_2 = \frac{\Delta_2}{\Delta} = \frac{\begin{vmatrix} 14 & 42 & 2 \\ -10 & -20 & 4 \\ -2 & -56 & 8 \end{vmatrix}}{\Delta} = 5\,A$$

$$I_3 = \frac{\Delta_3}{\Delta} = \frac{\begin{vmatrix} 14 & 10 & 42 \\ -10 & -16 & -20 \\ -2 & 4 & -56 \end{vmatrix}}{\Delta} = 10\,A$$

$$I_5 = I_1 + I_3 = 8\,A$$

$$I_4 = I_3 - I_2 = 5\,A$$

$$I_6 = I_1 + I_2 = 3\,A$$