UMSS-FCYT
DEPARTAMENTO DE ELECTRICIDAD
SEMESTRE 1-2023

PRIMER PARCIAL - CIRCUITOS ELECTRICOS III

APELLIDOS:.. NOMBRES:..
CARRERA:.. CARNET DE IDENTIDAD:..............................

1.- Se aplica la corriente: $i_{g(t)} = 22u(-t) + 10e^{-500t}u(t)A$ al circuito de la figura.

a) Determinar la corriente del capacitor: $i_{0(0^+)}$ aplicando el teorema del valor inicial

b) Hallar para t>0 la corriente $i_{0(t)}$

2.- En el circuito trifásico equilibrado de la figura, se conoce: $\overline{I}_{AN} = 4.25\angle -85^\circ A$ r.m.s; $\overline{I}_{AC} = 4.378\angle -100.68^\circ A$ r.m.s; $Z_Y = 65 + j70\Omega$; $Z_L = 5.4 + j6.25\Omega$

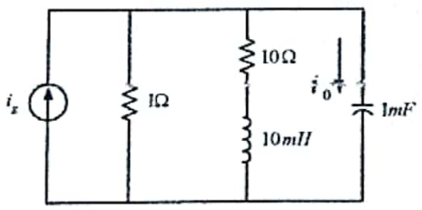
a) Determinar el valor de la impedancia Z_Δ si la secuencia es positiva

b) Determine la potencia trifásica total que entrega el generador por el método de los dos vatímetros

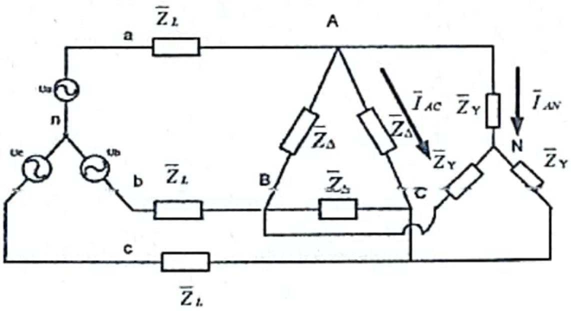
3.- En el circuito desequilibrado de la figura: $Z_L = 14 + j10\Omega$; $Z_1 = 55 + j65\Omega$; $Z_2 = 60 + j75\Omega$; $Z_3 = 35 - j45\Omega$. Determinar la potencia trifásica por el método de los dos vatímetros y por la forma tradicional. Verifique que sale aproximadamente el mismo resultado sabiendo que el voltaje de línea en el generador trifásico es: $\overline{U}_{ab} = 345\angle -155^\circ V$ r.m.s y la secuencia es negativa.

4.- Hallar el voltaje v_0 para t>0 y para t=5s en el circuito mostrado en la figura

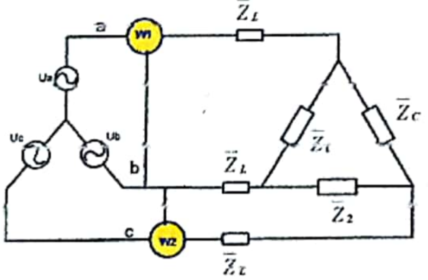
PROBLEMA 1



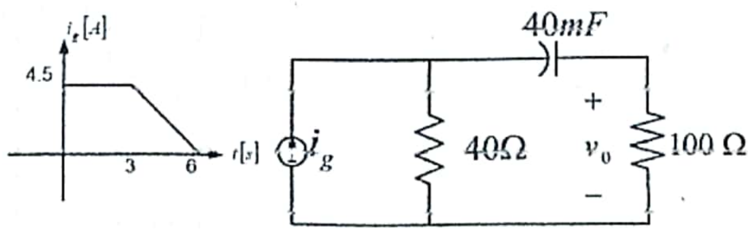
PROBLEMA2



PROBLEMA 3



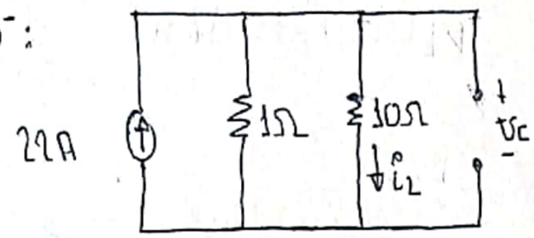
PROBLEMA 4



1er Parcial _ Cir 3

1.- $i_g(t) = 22\,u(-t) + 10e^{-500t}\,u(t)$

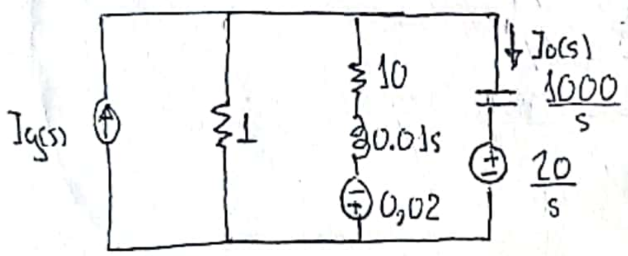
a) $t = 0^-$:



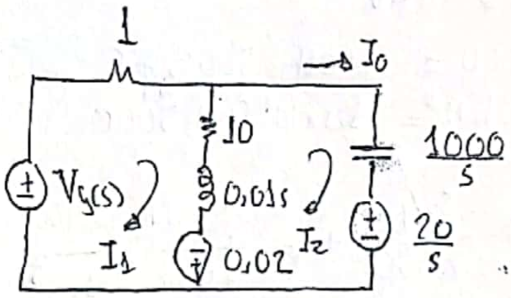
$i_L = \frac{1}{11}\cdot 22 \Rightarrow \boxed{i_L = 2A}$

$\underline{v_C = 20V}$

$t > 0$: $\quad I_g(s) = \frac{10}{s+500}$



$\Rightarrow$



$V_g(s) = \frac{10}{s+500}$

$$\begin{cases} (11+0{,}01s)I_1 - (10+0{,}01s)I_2 = 0{,}02 + \frac{10}{s+500} \\ -(10+0{,}01s)I_1 + \left(10+0{,}01s+\frac{1000}{s}\right)I_2 = -\frac{20}{s} - 0{,}02 \end{cases}$$

$$I_2 = \frac{\begin{vmatrix} 11+0{,}01s & 0{,}02+\frac{10}{s+500} \\ -(10+0{,}01s) & -\frac{20}{s}-0{,}02 \end{vmatrix}}{\begin{vmatrix} 11+0{,}01s & -(10+0{,}01s) \\ -(10+0{,}01s) & 10+0{,}01s+\frac{1000}{s} \end{vmatrix}} = \frac{(11+0{,}01s)\left(-\frac{20}{s}-0{,}02\right) + (10+0{,}01s)\left(0{,}02+\frac{10}{s+500}\right)}{(11+0{,}01s)\left(10+0{,}01s+\frac{1000}{s}\right) - (10+0{,}01s)^2}$$

$$I_o(s) = \frac{-\frac{220}{s} - 0{,}22 - \cancel{0{,}2} - \cancel{2\times10^{-4}s} + \cancel{0{,}2} + \frac{100}{s+500} + \cancel{2\times10^{-4}s} + \frac{0{,}1s}{s+500}}{110 + 0{,}11s + \frac{11000}{s} + 0{,}1s + \cancel{1\times10^{-4}s^2} + 10 - 100 - 0{,}2s - \cancel{1\times10^{-4}s^2}}$$

$$I_o(s) = \frac{-\frac{220}{s} - 0{,}22 + \frac{0{,}1s+100}{s+500}}{20 + 0{,}01s + \frac{11000}{s}} = \frac{\frac{-220s - 110000 - 0{,}22s(s+500) + 0{,}1s^2 + 100s}{\cancel{s}(s+500)}}{\frac{20s + 0{,}01s^2 + 11000}{\cancel{s}}}$$

$$I_o(s) = \frac{-0{,}12s^2 - 230s - 110000}{(s+500)(0{,}01s^2 + 20s + 11000)} \quad \% \, 0{,}01$$

$$I_o(s) = \frac{-12s^2 - 23000s - 11\times10^6}{(s+500)(s^2+2000s+1{,}1\times10^6)}$$

a) $i_o(0^+) = \lim_{s\to\infty} \frac{-12s^3 - 23000s^2 - 11\times10^6 s}{(s+500)(s^2+2000s+1{,}1\times10^6)} \Rightarrow \boxed{i_o(0^+) = -12\,A}$

b) $\frac{-12s^2 - 23000s - 11\times10^6}{(s+500)(s^2+2000s+1{,}1\times10^6)} = \frac{A}{s+500} + \frac{Bs+C}{s^2+2000s+1{,}1\times10^6}$ $\quad \pm 1000^2$

$-12s^2 - 23000s - 11\times10^6 = A(s^2+2000s+1{,}1\times10^6) + (Bs+C)(s+500)$

$s^2: \; -12 = A+B$

$s: \; -23000 = 2000A + 500B + C \quad \Rightarrow \quad A = -50/7, \; B = -34/7, \; C = -\frac{44000}{7}$

cte: $-11\times10^6 = 1{,}1\times10^6 A + 500C$

$$i_o(t) = \mathcal{L}^{-1}\left\{ \frac{-50/7}{s+500} + \frac{-\frac{34}{7}(s+1000-1000) - \frac{44000}{7}}{(s+1000)^2 + 1\times10^5} \right\}$$

$$\boxed{i_o(t) = \left[-\frac{50}{7}e^{-500t} + e^{-1000t}\cdot\left(-\frac{34}{7}\cos(316{,}2t) - 4{,}518\cos(316{,}2t)\right)\right]u(t)\,A}$$

2.- $\bar{I}_{AN} = 4{,}25\angle{-85^\circ}\,A \quad \bar{I}_{AC} = 4{,}378\angle{-100{,}68^\circ}\,A; \; Z_Y = 65+j70\,\Omega; \; Z_L = 5{,}4+j6.25\,\Omega$

a) $\bar{U}_{AN} = Z_Y \cdot \bar{I}_{AN} = 405{,}98\angle{-37{,}88^\circ}\,V \Rightarrow \bar{U}_{AB} = 703{,}18\angle{-7{,}88^\circ}\,V$ Sec. (+)

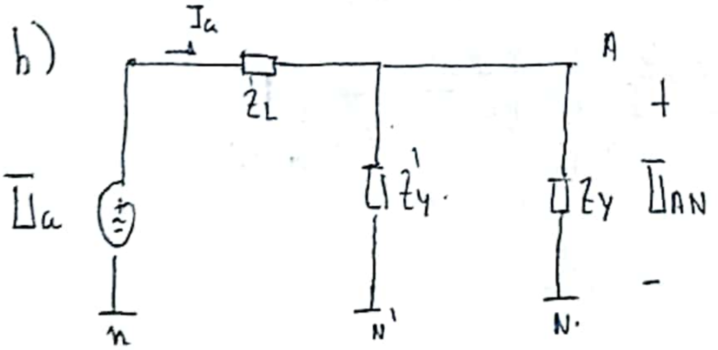
$\xrightarrow{+120^\circ} \bar{U}_{CA} = 703{,}18\angle{112{,}12^\circ}\,V$

$\bar{U}_{AC} = -\bar{U}_{CA} = 703{,}18\angle{-67{,}88^\circ}\,V$

$Z_\Delta = \frac{\bar{U}_{AC}}{\bar{I}_{AC}} \Rightarrow \boxed{Z_\Delta = 135+j87\,\Omega}$

$Z'_Y = \frac{Z_\Delta}{3} = 45+j29\,\Omega$

b)



$Z_1 = Z'_Y \,||\, Z_Y = 27{,}26+j21{,}24\,\Omega$

$Z_{eq} = Z_L + Z_1 = 32{,}66+j27{,}5\,\Omega$

$Z_{eq} = 42{,}69\angle{40{,}1^\circ}\,\Omega$

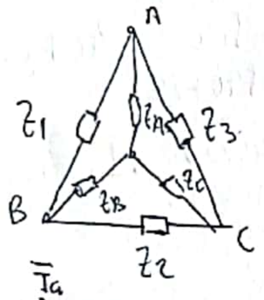
$\bar{I}_a = \dfrac{\bar{U}_{AN}}{Z_1} = 11{,}75\,\underline{/-75{,}8^\circ}\ A \qquad I_L = 11{,}75\,A \qquad \varphi = 40{,}1^\circ$

$\bar{U}_a = \bar{I}_a \cdot Z_{eq} = 501{,}67\,\underline{/-35{,}7^\circ}\ V \rightarrow U_L = 868{,}92\ V$

$$\left.\begin{aligned} W_1 &= 868{,}92 \times 11{,}75\cos(40{,}1^\circ - 30^\circ) = 10051{,}6\,W \\ W_2 &= 868{,}92 \times 11{,}75\cos(40{,}1^\circ + 30^\circ) = 3475{,}2\,W \end{aligned}\right\} \boxed{P_T = 13527\ W}$$

3.- $\bar{U}_{ab} = 345\,\underline{/-155^\circ}\ V \rightarrow \bar{U}_{ba} = 345\,\underline{/25^\circ}\ V \rightarrow \bar{U}_{ac} = 345\,\underline{/-95^\circ}\ V$

$\bar{U}_a = 199{,}2\,\underline{/-125^\circ}\ V \rightarrow \bar{U}_b = 199{,}2\,\underline{/-5^\circ}\ V;\ \bar{U}_c = 199{,}2\,\underline{/115^\circ}\ V$



$Z_1 = 55 + j65\,\Omega$

$Z_2 = 60 + j75\,\Omega$

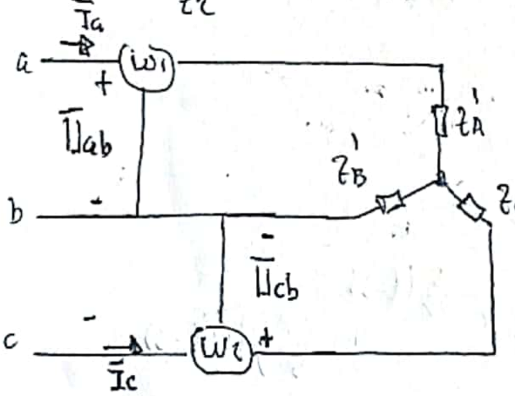
$Z_3 = 35 - j45\,\Omega$

$Z_L = 14 + j10\,\Omega$

$Z_A = \dfrac{Z_1 Z_3}{Z_T} = 22{,}47 - j15{,}57\,\Omega$

$Z_B = \dfrac{Z_1 Z_2}{Z_T} = 16{,}69 + j42{,}93\,\Omega$

$Z_C = \dfrac{Z_2 Z_3}{Z_T} = 25{,}82 - j16{,}86\,\Omega$



$$\boxed{\begin{aligned} Z'_A &= Z_L + Z_A = 36{,}47 - j5{,}57\,\Omega \\ Z'_B &= Z_L + Z_B = 30{,}69 + j52{,}93\,\Omega \\ Z'_C &= Z_L + Z_C = 39{,}82 - j6{,}86\,\Omega \end{aligned}}$$

$$\bar{U}_0 = \dfrac{\dfrac{\bar{U}_a}{Z'_A} + \dfrac{\bar{U}_b}{Z'_B} + \dfrac{\bar{U}_c}{Z'_C}}{\dfrac{1}{Z'_A} + \dfrac{1}{Z'_B} + \dfrac{1}{Z'_C}} \Rightarrow$$

$\bar{U}_0 = 89{,}63\,\underline{/-130^\circ}\ V \Rightarrow$

$\bar{I}_a = \dfrac{\bar{U}_a - \bar{U}_0}{Z'_A} = 2{,}99\,\underline{/-112{,}23^\circ}\ A$

$\bar{U}_{ab} = 345\,\underline{/-155^\circ}\ V$

$\bar{U}_{cb} = 345\,\underline{/145^\circ}\ V$

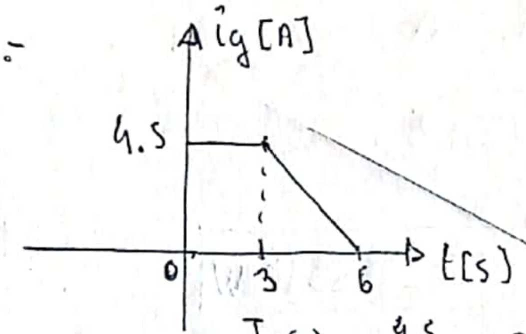
$\bar{I}_b = \dfrac{\bar{U}_b - \bar{U}_0}{Z'_B} = 4{,}27\,\underline{/-48{,}57^\circ}\ A$

$\bar{I}_c = \dfrac{\bar{U}_c - \bar{U}_0}{Z'_C} = 6{,}2\,\underline{/105{,}86^\circ}\ A$

$$\left.\begin{aligned} W_1 &= 345 \times 2.99\cos(-155^\circ + 112{,}23^\circ) = 757{,}25\,W \\ W_2 &= 345 \times 6{,}2\cos(145^\circ - 105{,}86^\circ) = 1659{,}02\,W \end{aligned}\right\} \boxed{P_T = 2416.27\,W}$$

$P_T = 2{,}99^2 \times 36{,}47 + 4{,}27^2 \times 30{,}69 + 6{,}2^2 \times 39{,}82 \rightarrow \boxed{P_T = 2416{,}3\,W}$

4.-



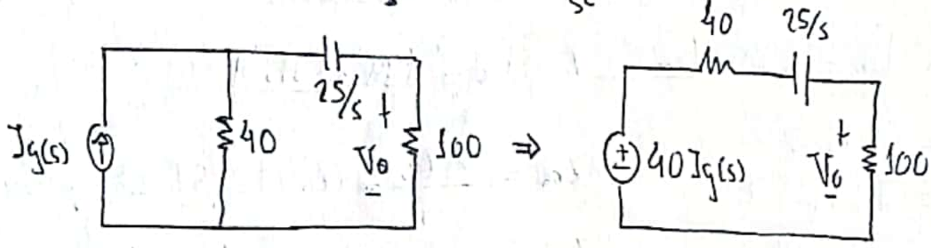
$$i_g(t) = \begin{cases} 4.5\ A & 0 < t < 3s \\ -1.5t + 9\ A & 3 < t < 6s \end{cases}$$

$$i_g(t) = 4.5\left(u(t) - u(t-3)\right) + (-1.5t+9)\left(u(t-3) - u(t-6)\right)$$

$$i_g(t) = 4.5u(t) + (-1.5t+4.5)u(t-3) + (1.5t-9)u(t-6)$$

$$I_g(s) = \frac{4.5}{s} + e^{-3s}\mathcal{L}\{-1.5(t+3)+4.5\} + e^{-6s}\mathcal{L}\{1.5(t+6)-9\}$$

$$I_g(s) = \frac{4.5}{s} - \frac{1.5}{s^2}e^{-3s} + \frac{1.5}{s^2}e^{-6s}$$



$$V_o(s) = \frac{100}{140 + \frac{25}{s}} \cdot 40 I_g(s)$$

$$V_o(s) = \frac{4000s}{140s+25} \cdot I_g(s)$$

$$V_o(s) = \frac{18000}{140s+25} - \frac{6000\,e^{-3s}}{s(140s+25)} + \frac{6000\,e^{-6s}}{s(140s+25)} \qquad \div 140$$

$$V_o(s) = \frac{900/7}{s+5/28} - \frac{300/7\; e^{-3s}}{s(s+5/28)} + \frac{300/7\; e^{-6s}}{s(s+5/28)}$$

$$\mathcal{L}^{-1}\left\{\frac{1}{s(s+5/28)}\right\} = \int_0^t e^{-5/28\,t}\,dt = -\frac{28}{5}e^{-5/28\,t} + \frac{28}{5}$$

$$V_o(t) = \mathcal{L}^{-1}\{V_o(s)\} = \frac{900}{7}e^{-\frac{5}{28}t}u(t) - \frac{300}{7}\cdot\left(-\frac{28}{5}e^{-\frac{5}{28}(t-3)} + \frac{28}{5}\right)u(t-3)$$
$$+ \frac{300}{7}\cdot\left(-\frac{28}{5}e^{-5/28(t-6)} + \frac{28}{5}\right)u(t-6)$$

$$\boxed{V_o(t) = \frac{900}{7}e^{-5/28\,t}u(t) + \left(240e^{-5/28(t-3)} - 240\right)u(t-3) + \left(-240e^{-\frac{5}{28}(t-6)} + 240\right)u(t-6)\ V}$$

$t = 5s$;
$$V_o = \frac{900}{7}e^{-25/28} + 240e^{-\frac{5}{28}\cdot 2} - 240$$

$$\boxed{V_o = -19{,}43\ V}$$

Escaneado con CamScanner