UNIVERSIDAD DE LAS FUERZAS ARMADAS

"ESPE"

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1. La salida de un generador de ca tiene un valor máximo de 250 V. ¿A qué ángulo el valor instantáneo es igual a 75 V?

$$V_\alpha = V_{max} * \sin\alpha$$
$$\sin(\alpha) = \frac{V_\alpha}{V_{\max}} ==> \alpha = \arcsin\left(\frac{V_\alpha}{V_{\max}}\right)$$
$$\alpha = \arcsin\left(\frac{75}{250}\right)$$
$$==> \alpha = 17{,}45°$$

2. Cierto generador trifásico de dos polos tiene una velocidad de rotación de 60 rpm. ¿Cuál es la frecuencia de cada voltaje producido por este generador? ¿Cuál es el ángulo de fase entre cada voltaje?

$$\omega = 60rmp ==> 6{,}28\frac{rad}{seg}$$
$$f = \frac{\omega}{2\pi} ==> f = \frac{6{,}28}{2\pi} = 0{,}99\ Hz$$

Para el periodo

$$T = \frac{1}{f} ==> T = 1\ seg$$

Para el ángulo de fase

$$\theta_1 = 0$$
$$\theta_2 = 2\pi$$
$$\theta_2 - \theta_1 = 2\pi$$

3. Un generador monofásico alimenta una carga compuesta por un resistor de 200 Æ y un capacitor con reactancia de 175 Æ. El generador produce un voltaje de 100 V. Determine la magnitud de la corriente de carga

$$R = 200\ \Omega \qquad X_L = 175\ \Omega$$
$$Z = 200 - j175\ \Omega$$
$$I = \frac{100 < 0}{200 - j175} = \frac{100 < 0}{265{,}75 < -41{,}18}$$
$$I = 0{,}376 < 41{,}18\ A$$
$$I = 376\ mA$$

4. Determine la fase de la corriente de carga con respecto al voltaje del generador del problema 3.

$$I = 376\ mA \quad y \quad V = 100\ V$$
$$fase = 90°$$

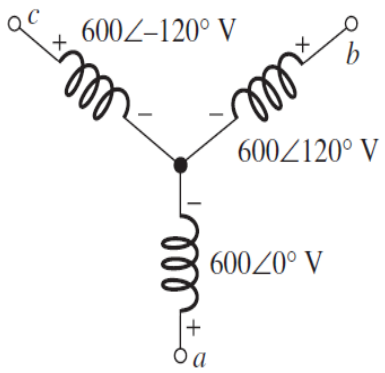
5. Una carga trifásica desbalanceada en un sistema de cuatro hilos tiene corrientes de 2 ∠ 20° A, 3 ∠ 140°, y 1.5 ∠ 100° A. Determine la corriente en la línea neutra.

$$I_{RN} = L_{RL1} + L_{RL2} + L_{RL3}$$

$$I_{RN} = 2 < 20 + 3 < 140 + 1{,}5 < -100$$
$$I_{RN} = 1{,}88 + j0{,}68 - 2{,}29 + j1{,}92 - 0{,}26 - j1{,}47$$
$$I_{RN} = -0{,}67 + j1{,}13 == I_{RN} = 1{,}31 < 120{,}66\ A$$

TIPOS DE GENERADORES:

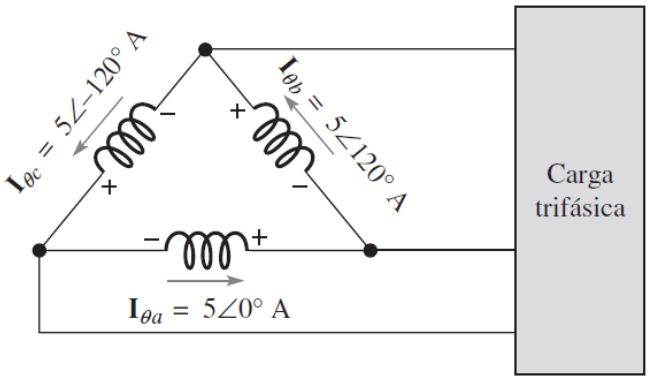
6. –*Determine los voltajes de linea en la figura* 21 – 36



▲ FIGURA 21–35

–*Usamos la siguiente formula*: $V_{L(ab)} = \sqrt{3}V_{\theta}$ *Entonces*: $V_{L(ab)} = \sqrt{3}(600)\angle 30°$ $V_{L(ab)} = 1039\angle 30°$	$V_{L(ac)} = \sqrt{3}(600)\angle -90°$ $V_{L(ac)} = 1039\angle -90°$ $V_{L(cb)} = \sqrt{3}(600)\angle 150°$ $V_{L(cb)} = 1039\angle 150°$

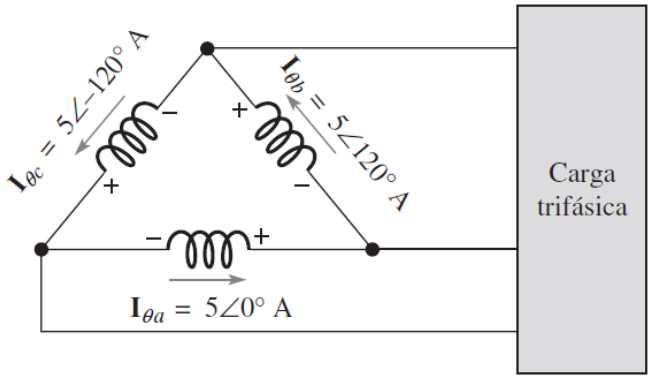
7. –*Determine las corrientes de linea en la Figura* 21 – 36



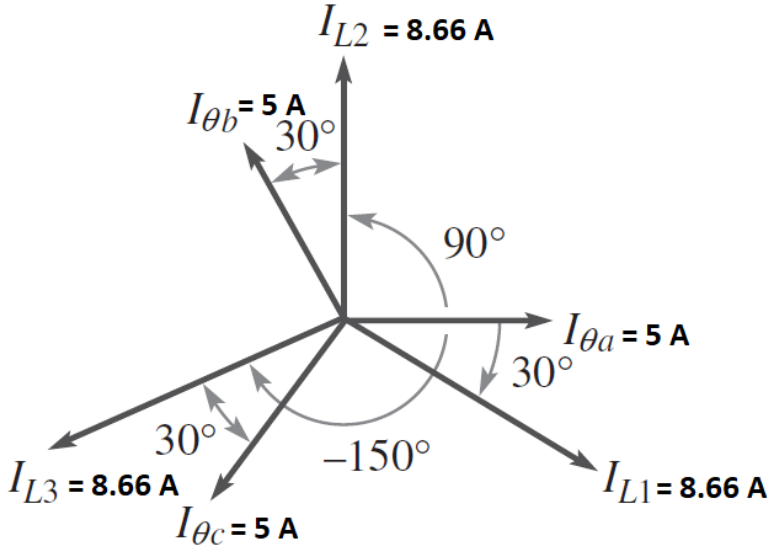
▲ FIGURA 21–36

Datos: $I_{\theta a} = 5\angle 0°$ $I_{\theta b} = 5\angle 120°$ $I_{\theta c} = 5\angle -120°$ –*Usamos la siguiente formula*: $I_L = \sqrt{3}I_{\theta}\angle -30°$	*Entonces*: $I_{L1} = \sqrt{3}(5)\angle -30°$ $I_{L1} = 8.66\angle -30°$ $I_{L2} = \sqrt{3}(5)\angle 90°$ $I_{L2} = 8.66\angle 90°$ $I_{L3} = \sqrt{3}(5)\angle -150°$ $I_{L3} = 8.66\angle -150°$

8. –*Desarrolle un diagrama fasorial de corriente completo para la figura* 21 – 36



▲ FIGURA 21–36

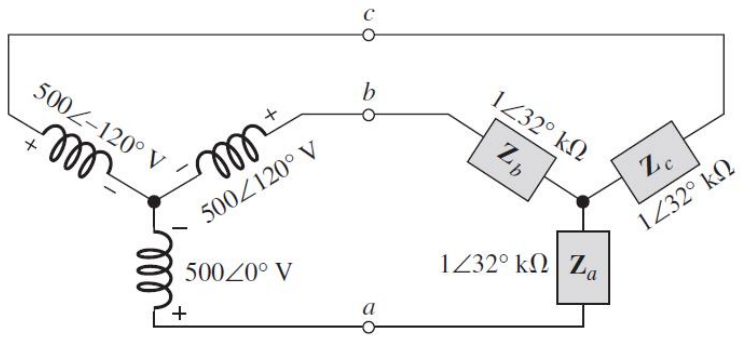


ANALISIS DE FUENTES Y CARGA TRIFASICA:

9. −Determine las siguientes cantidades para el sistema Y − Y de la $figura\ 21-37$:

$a).\ Los\ voltajes\ de\ linea$ $b).\ Las\ corrientes\ de\ fase$ $c).\ Las\ corrientes\ de\ linea$

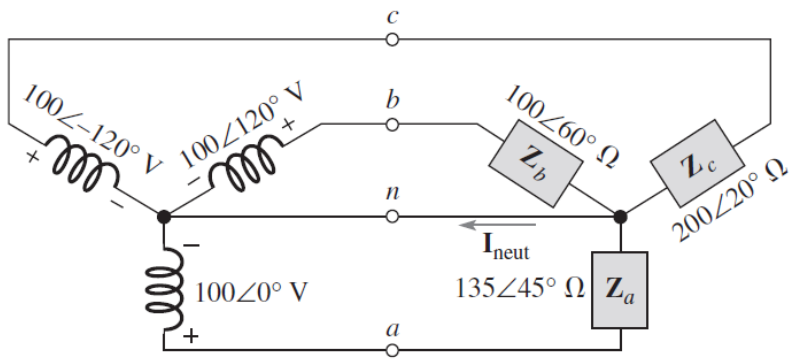
$d).\ Las\ corrientes\ de\ carga$ $e).\ Los\ voltajes\ de\ carga$



▲ FIGURA 21–37

$a).-$ $-Usamos\ la\ siguiente\ formula$: $$V_L = \sqrt{3}V_\theta$$ $Entonces$: $$V_{L1} = \sqrt{3}(500)\angle 150°$$ $$V_{L1} = 866.02\angle 150°\ A$$ $$V_{L2} = \sqrt{3}(500)\angle -30°$$ $$V_{L2} = 866.02\angle -30°$$ $$V_{L3} = \sqrt{3}(500)\angle -90°$$ $$V_{L3} = 866.02\angle -90°$$	$c).-$ $$I_{L1} = (0.5\angle -32°)A$$ $$I_{L2} = (0.5\angle -88°)A$$ $$I_{L3} = (0.5\angle -152°)A$$
	$d).-$ $$I_{\theta a} = (0.5\angle -32°)A$$ $$I_{\theta b} = (0.5\angle -88°)A$$ $$I_{\theta c} = (0.5\angle -152°)A$$
$b).-$ $$I_{za} = \frac{500\angle 0°}{1000\angle 32°} = (0.5\angle -32°)A$$ $$I_{za} = \frac{500\angle 120°}{1000\angle 32°} = (0.5\angle 88°)A$$ $$I_{za} = \frac{500\angle 0°}{1000\angle 32°} = (0.5\angle -152°)A$$	$e).-$ $$V_{Za} = (500\angle 0°)A$$ $$V_{Zb} = (500\angle 120°)A$$ $$V_{Zc} = (500\angle -120°)A$$

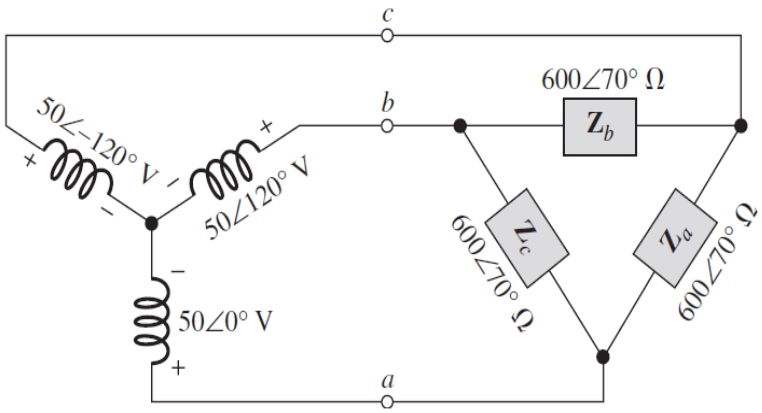
10. −*Repita el problema* 9 *para el sistema de la figura* 21 − 38, *y tambien determine la corriente neutra.*



▲ FIGURA 21–38

a). − −*Usamos la siguiente formula*: $$V_L = \sqrt{3}V_\theta$$ *Entonces*: $$V_{L1} = \sqrt{3}(100)\angle -150°$$ $$V_{L1} = 173.2\angle -150°\ V$$ $$V_{L2} = \sqrt{3}(100)\angle -30°$$ $$V_{L2} = 173.2\angle -30°V$$ $$V_{L3} = \sqrt{3}(100)\angle 90°$$ $$V_{L3} = 173.2\angle 90°V$$	*c*). − $$I_{L1} = (0.74\angle -45°)A$$ $$I_{L2} = (1\angle 60°)A$$ $$I_{L3} = (0.5\angle -140°)A$$ *d*). − $$I_{\theta a} = (0.74\angle -45°)A$$ $$I_{\theta b} = (1\angle 60°)A$$ $$I_{\theta c} = (0.5\angle -140°)A$$
b). − $$I_{za} = \frac{100\angle 0°}{135\angle 45°} = (0.74\angle -45°)A$$ $$I_{za} = \frac{100\angle 120°}{100\angle 60°} = (1\angle 60°)A$$ $$I_{za} = \frac{100\angle -120°}{200\angle 20°} = (0.5\angle -140°)A$$	*e*). − $$V_{Za} = (100\angle 0°)V$$ $$V_{Zb} = (100\angle 120°)V$$ $$V_{Zc} = (100\angle -120°)V$$
f). − $$I_{neutra} = I_{Za} + I_{Zb} + I_{Zc}$$ $$= (0.52 - j0.52) + (0.5 + j0.86) + (-0.38 - j0.32)$$ $$I_{neutra} = (0.64 + j0)A$$	

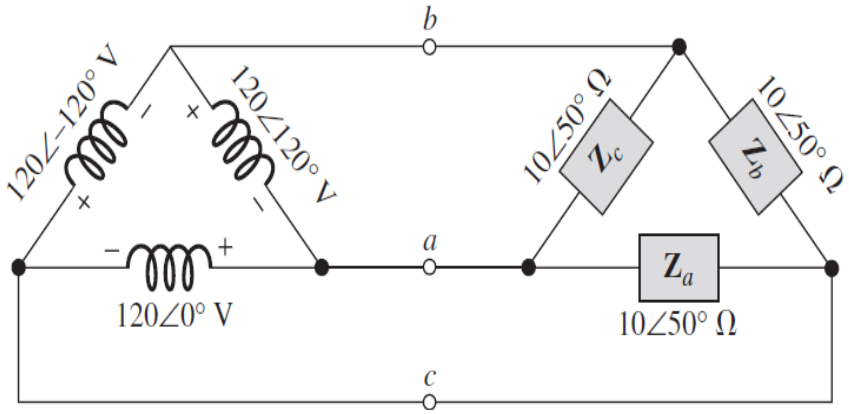
11. −*Repita el problema* 9 *para el sistema de la figura* 21 − 39:



▲ FIGURA 21–39

$a).-$ $-Usamos\ la\ siguiente\ formula$: $$V_L = \sqrt{3}V_\theta$$ $Entonces$: $$V_{L1} = \sqrt{3}(50)\angle 150°$$ $$V_{L1} = 86.6\angle 150°\ V$$ $$V_{L2} = \sqrt{3}(50)\angle 30°$$ $$V_{L2} = 86.6\angle 30°V$$ $$V_{L3} = \sqrt{3}(50)\angle -90°$$ $$V_{L3} = 86.6\angle -90°V$$	$c).-$ $$I_{L1} = (0.14\angle -70°)A$$ $$I_{L2} = (0.14\angle 50°)A$$ $$I_{L3} = (0.14\angle -190°)A$$ $d).-$ $$I_{\theta a} = (0.083\angle -70°)A$$ $$I_{\theta b} = (0.083\angle 50°)A$$ $$I_{\theta c} = (0.0.83\angle -190°)A$$
$b).-$ $$I_{za} = \frac{50\angle 0°}{600\angle 70°} = (0.083\angle -70°)A$$ $$I_{za} = \frac{50\angle 120°}{600\angle 70°} = (0.083\angle 50°)A$$ $$I_{za} = \frac{50\angle -120°}{600\angle 70°} = (0.083\angle -190°)A$$	$e).-$ $$V_{Za} = (86.6\angle 150°)V$$ $$V_{Zb} = (86.6\angle 30°)V$$ $$V_{Zc} = (86.6\angle -90°)V$$

12. −*Repita el problema* 9 *para el sistema de la figura* 21 − 40:



▲ FIGURA 21–40

a). − −*Usamos la siguiente formula*: $$V_L = V_L = V_Z$$ *Entonces*: $$V_{L1} = 120\angle 0°\, V$$ $$V_{L2} = 120\angle 120°V$$ $$V_{L3} = 120\angle -120°V$$	*c*). − $$I_{L1} = (83.3\angle -100°)A$$ $$I_{L2} = (83.3\angle 60°)A$$ $$I_{L3} = (0.83.3\angle -228°)A$$ *d*). − $$I_{\theta a} = (48.1\angle -70°)A$$ $$I_{\theta b} = (48.1\angle 50°)A$$ $$I_{\theta c} = (48.1\angle -190°)A$$
b). − $$I_{za} = \frac{50\angle 0°}{\sqrt{3}(600)\angle 70°} = (48.1\angle -70°)mA$$ $$I_{za} = \frac{50\angle 120°}{\sqrt{3}(600)\angle 70°} = (48.1\angle 50°)mA$$ $$I_{za} = \frac{50\angle -120°}{\sqrt{3}(600)\angle 70°} = (48.1\angle -190°)mA$$	*e*). − $$V_{Za} = (120\angle 0°)V$$ $$V_{Zb} = (120\angle 120°)V$$ $$V_{Zc} = (120\angle -160°)V$$

13. $-Determine\ los\ voltajes\ de\ linea\ y\ las\ corrientes\ de\ carga\ para\ el\ sistema\ de\ la\ figura\ 21-41$

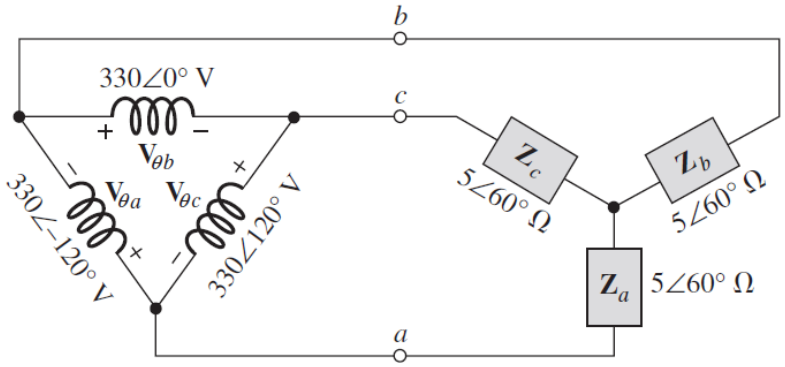


FIGURA 21–41

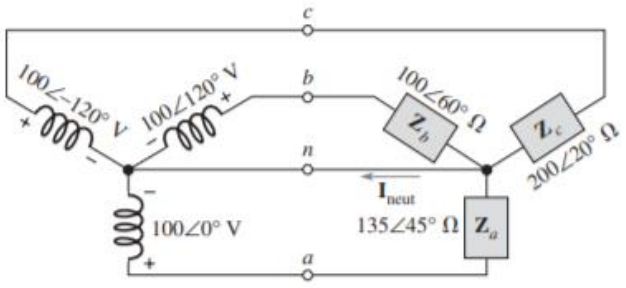
$a).-Usamos\ la\ siguiente\ formula$:	$b).-Usamos\ la\ siguiente\ formula$:
$V_L = V_\theta$ $Entonces$: $V_{L1} = (330\angle -120°)V$ $V_{L2} = (330\angle 120°)V$ $V_{L3} = (330\angle 0°)V$	$I_Z = \frac{V_{Za}}{Z_a}$ $I_{Za} = \frac{330\angle -120°}{5\angle 60°} = (66\angle -180°)$ $I_{Zb} = \frac{330\angle 120°}{5\angle 60°} = (66\angle 2°)$ $I_{Zc} = \frac{330\angle 0°}{5\angle 60°} = (66\angle -60°)$

14. La potencia en cada fase de un sistema trifásico balanceado es de 1200 W. ¿Cuál es la potencia total?

$$PT = P1 + P2 + P3$$

$$PT = 3600w$$

15. Determine la potencia suministrada a la carga en las figuras 21-37 a 21-41



$$Iza = 0.05/-32°$$

$$Iza = 0.05/88°$$

$$Iza = 0.05/-152°$$

$$Fp = 0.84$$

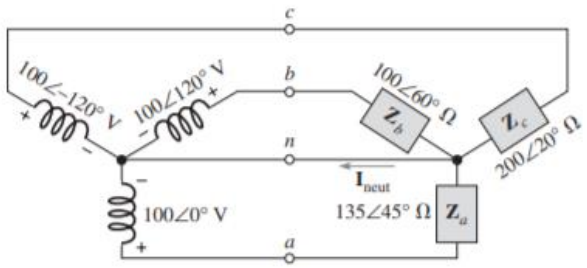
$$VL = 886.02/-120°$$

$$VL = 886.02/0°$$

$$VL = 886.02/120°$$

$$P = (3)^{1/2}\, VLILcos°$$

$$P = 62.99w$$



▲ FIGURA 21–38

$$Iza = 0.05/-32°$$

$$Iza = 0.05/88°$$

$$Iza = 0.05/-152°$$

$$Fp = 0.84$$

$$VL = 886.02/-120°$$

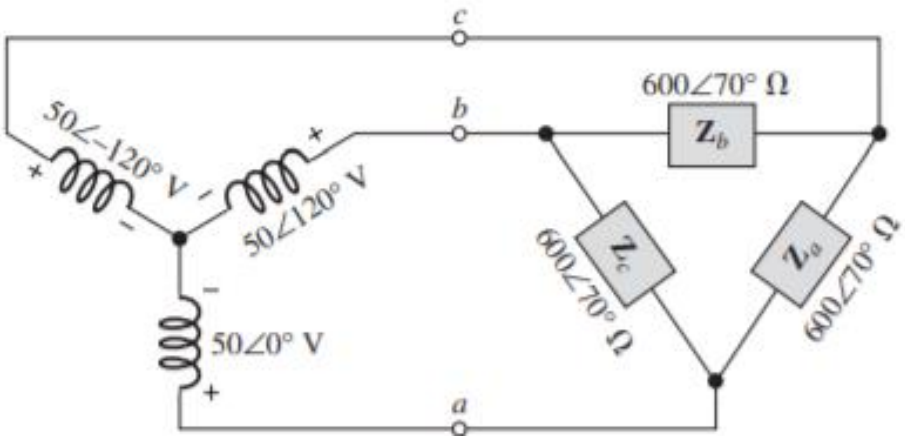
$$VL = 886.02/0°$$

$$VL = 886.02/120°$$

$$P = (3)^{1/2}\, VLILcos°$$

$$P = 149.31w$$

11. Repita el problema 9 para el sistema de la figura 21-39.



$$Iza = 0.05/-32°$$

$$Iza = 0.05/88°$$

$$Iza = 0.05/-152°$$

$$Fp = 0.84$$

$$VL = 886.02/-120°$$

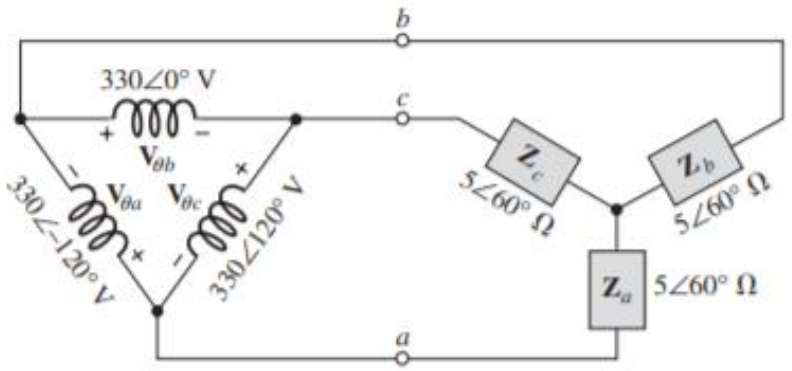
$$VL = 886.02/0°$$

$$VL = 886.02/120°$$

$$P = (3)^{1/2}\, VLILcos°$$

$$P = 12.8w$$

13. Determine los voltajes de línea y las corrientes de carga para el sistema de la figura 21-41.



▲ **FIGURA 21–41**

$$Iza = 0.05/-32°$$

$$Iza = 0.05/88°$$

$$Iza = 0.05/-152°$$

$$Fp = 0.84$$

$$VL = 886.02/-120°$$

$$VL = 886.02/0°$$

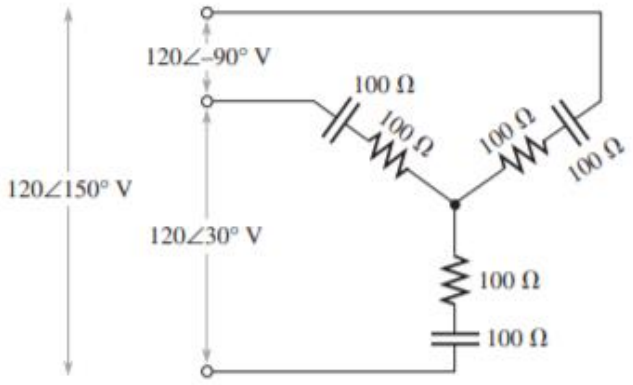
$$VL = 886.02/120°$$

$$P = (3)^{1/2}\, VLILcos°$$

$$P = 10.91w$$

16. Determine la potencia total suministrada a la carga en la figura 21-42.

► FIGURA 21–42



En cada impedancia obtenemos el valor siguiente:

$$Z = 100 - j100\ \Omega$$

$$Z = 141.421\angle -45°\ \Omega$$

Para hallar el voltaje de carga:

$$V_L = \sqrt{3}\, V_Z$$

$$V_Z = \frac{V_L}{\sqrt{3}} = \frac{120}{\sqrt{3}} = 69.282V$$

Por lo que el valor de la magnitud de la corriente es:

$$I_Z = \frac{V_Z}{Z} = \frac{69.282V}{141.421\Omega} = 489.899\ mA$$

Aplicando la fórmula de potencia:

$$P_{L(tot)} = 3V_Z I_Z \cos\theta = 3(69.282V)(489.899\ mA)\cos -45°$$

$$P_{L(tot)} = 72\ \text{W}$$