Problems (AC)

[1] A 200V, 50HZ supply is connected to coil ~~of~~ inductance (0.15H) connected in series with 32 Ω resistance

Determine

1. impedance of the Circuit.
2. current & circuit phase angle.
3. ~~Power dissipated~~ pd (potential difference) across 32 Ω.
4. " " " coil.

← Solution →

(a) $Z = R + j\omega L$

$= 32 + j(2 \times \pi \times 50 \times 0.15)$

$= 32 + j\underbrace{47.1}_{X_L} = 57\angle 55.81^\circ$

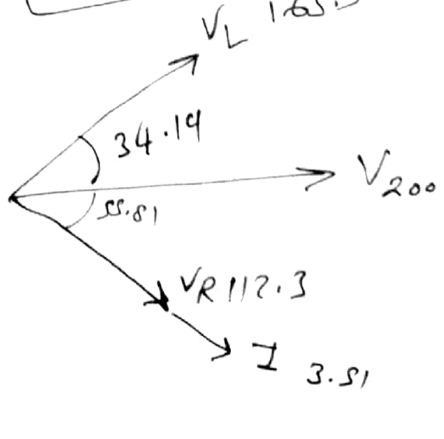
(b) $I = \frac{V}{Z} = \frac{200\angle 0}{57\angle 55.81} = 3.51\angle -55.81^\circ$

(c) $Pd|_{32\Omega} = V_R = IR = (3.51\angle -55.81)(32\angle 0)$

$= 112\angle -55.81^\circ$

(d) $Pd|_{coil} = V_L = I x_L = (3.51\angle -35.81)(47.1\angle 90)$

$= 165.3\angle 34.19^\circ$



③ << أبدأ بهم أول >>

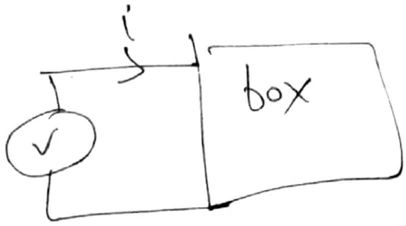
④

(امتحان الأخير)

if $v = 2\sin(100t + 45^\circ)$

$i = \cos(100t + 10^\circ)$

what type of impedance in box



sol

$$Z = \frac{v}{I} = \frac{2\angle 45}{1\angle 100} = 2\angle -55$$

$\cos(\omega t + 10) \equiv \sin(\omega t + 90 + 10)$

$= \underbrace{2\cos 55}_{R} - j\, 2\sin 55 \rightarrow$ capacitor $\frac{1}{\omega C} = 2\sin 55$

$\omega = 100$

$\therefore C = \checkmark$

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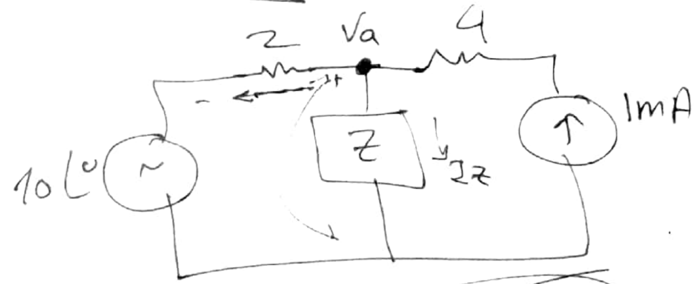
③ find Z if $V_a = 14 - j2$



$\therefore V_a - 10\angle 0 = V_{2\Omega}$

$14 - j2 - 10 = V_2 = +4 - j2$

$\therefore i_2 = \frac{4 - j2}{2} = 2 - j1$

$i_Z + i_2 = 1\,mA$

$i_Z + 2 - j1 = 1\times10^{-3}$

$i_Z = j1 + 2 + 1\times10^{-3}$

$\therefore \frac{V_a}{I_Z} = \frac{14 - j2}{(2 + 0.001) + j} = \frac{\square - j}{\square - j} \ldots \square - \square j$

فكرة قفشة

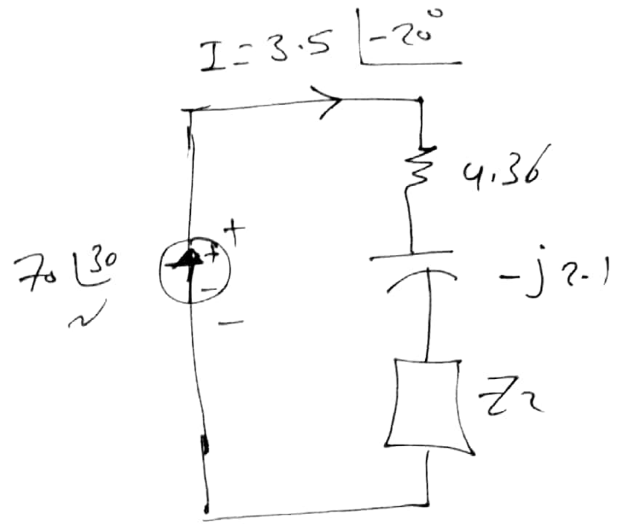
بجيب تيار Z وبجيب Va من Z بحساب Iz من 1mA وباقي Iz V2 + Vsupply

∴ يحتوي على R و C

معطوفين على R

ونعرف C منها او قيمتها

4 For the Circuit shown determine Z_2



solution →

$$Z_{total} = \frac{V}{I} = \frac{70\angle 30}{3.5\angle -20}$$

$$= 20\angle 50$$

$$= 12.86 + j15.32\ \Omega$$

but

$$Z = Z_2 + (4.36 - j2.1) \quad \underbrace{}_{R - j\frac{1}{\omega c}}$$

$$\therefore\ 12.86 + j15.32 = Z_2 + 4.36 - j2.1$$

$$Z_2 = 8.5 + j17.42 \quad \text{or} \quad 19.38\angle 63.99^\circ$$

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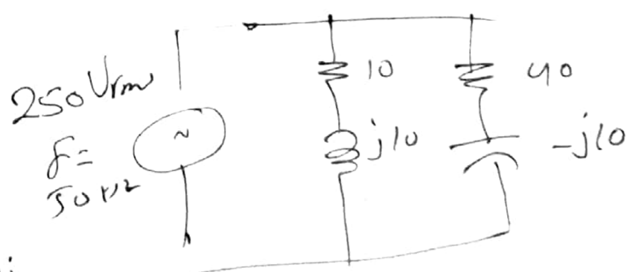
5 A series R-L branch with $R_1 = 10\Omega$, ~~R~~ $X_L = 10\Omega$ Connected in Parallel with series RC branch of $R_2 = 40\Omega$, $X_c = 10\Omega$, The Combination is connected ~~to~~ across 250V (rms) supply, 50Hz, find total impedance of circuit & total current (Magnitude & Phase)

Sol



$$Y_1 = \frac{1}{10 + j10} = \frac{10 - j10}{200}$$

$$= \frac{1}{20} - \frac{j}{20} = 0.05 - j0.05$$

$$Y_2 = \frac{1}{40 - j10} = \frac{40 + j10}{1600 + 100} = 0.0235 + 0.0058j$$

$$Y_t = Y_1 + Y_2 = 0.0735 - 0.0442j$$

$$= 0.857\angle 30.9$$

$$Z = \frac{1}{Y} = \frac{1\angle 0}{0.0857\angle -30.9} = 11.668\angle 30.9$$

$$= 10.01 + j5.995$$

$$I = \frac{V}{Z_{eq}} = \frac{250\sqrt{2}\angle 0}{11.668\angle 30.9} = 30.3\angle -30.9$$

or $21.42\angle -30.9$ rms

(3)

6] a series R-C ⊙ connected with AC supply with 100 Vrms & phase 45° at 50 Hz, if the magnitude of capacitive element is ~~double~~ ~~one half~~ one half of the pure element, find power factor

← Sol →

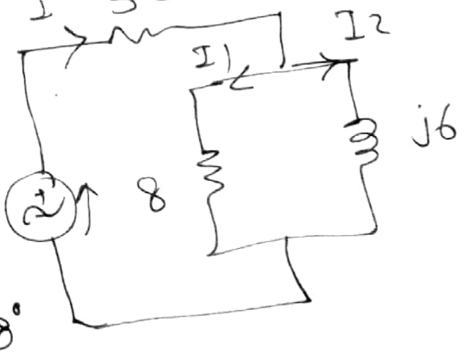
$$Z = R - j\left(\frac{1}{\omega C}\right) \qquad Pf = \cos \angle \text{phase angle of } Z$$

$$\left|\frac{1}{\omega C}\right| = \frac{1}{2}|R| \qquad \therefore \omega RC = 2$$

$$Pf = \cos\left[\tan^{-1}\frac{Img}{Real}\right] = \cos\left[\tan^{-1}\frac{-1}{\omega RC}\right]$$

$$= \cos\left[\tan^{-1}\frac{1}{2}\right] = 0.8944$$

7] determine I, I_1, I_2



$$Z_t = 5 + \frac{(8)(j6)}{8+j6} =$$

$$= 5 + \frac{48j[8-j6]}{(8)^2+(6)^2}$$

$$= 7.88 + j3.84\,\Omega \quad \text{or } 8.77\angle 25.98^\circ$$

$$I = \frac{V}{Z_t} = \frac{50\angle 0}{8.77\angle 25.98} = 5.7\angle -25.98^\circ$$

$$I_1 = I\left(\frac{j6}{8+j6}\right) = 5.7\angle -25.98 * \left[\frac{6\angle 90}{10\angle 36.87}\right] = 3.42\angle 27.15^\circ$$

$$I_2 = I\left(\frac{8}{8+j6}\right) = 5.7\angle -25.98\left(\frac{8\angle 0}{10\angle 36.87}\right) = 4.56\angle -62.85$$

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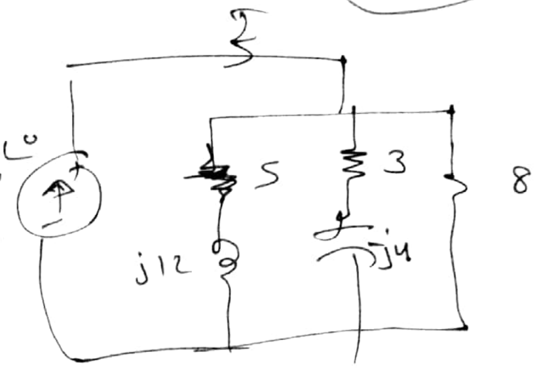
نترك لو مستر

5

مكرر فقط

8) For the parallel network shown find I

مكررة فقط



$$I = \frac{V}{Z} = VY = 40\angle 0\, Y$$

$$Y = Y_1 + Y_2 + Y_3$$

$$= \frac{1}{5+j12} + \frac{1}{3-j4} + \frac{1}{8}$$

$$= \frac{5-j12}{5^2+12^2} + \frac{3+j4}{3^2+4^2} + \frac{1}{8}$$

$$= (0.0296 - j0.07) + (0.12 + j0.16) + 0.125$$

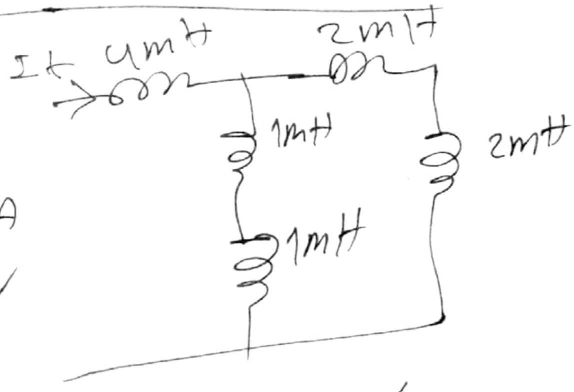
$$= 0.274 + j0.084 = 0.28\angle 17.9$$

$$\therefore I = VY = 11.55\angle 17.96$$

9

مكررة فقط

what freq. produce $I_t = 500\,mA$ if $V_t = 10\,V$



بما انه كله من نفس النوع (ملفات فقط)

∴ هات Leq واضربه في jw

تبقى Zeq

$$Z = \frac{V}{I} = \frac{10}{500\,mA} = 20$$

$$Z = j\omega L_{eq}$$

$$L_{eq} = \{(2m + 2m) \,//\, (1m + 1m)\} + 4m$$

$$= 5.33\,mH$$

$$|Z| = 2 * \pi * f * 5.33\,mH = 20$$

$$\therefore f = \frac{20}{2\pi \times 5.33 \times 10^{-3}} = 596.8\,Hz$$