Q1)- {15 Marks}

a)- Given $\omega = 314$ rad/s, determine how long it will take the sinusoidal waveform to pass through an angle of 90° {7Marks}

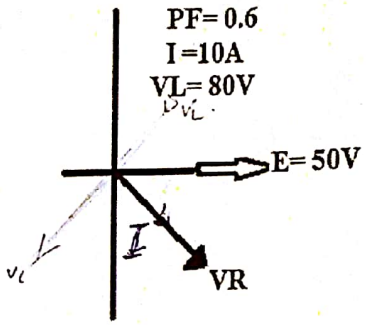
b)-The current through a 0.2-H coil is provided. Find the sinusoidal expression for the voltage across the coil. Sketch the v and i curves {8Marks}

$$i(t) = 7 \sin(377t - 70°)$$

Q2)- {15 Marks}

The phasor diagram of Series RLC circuit is shown in the fig:

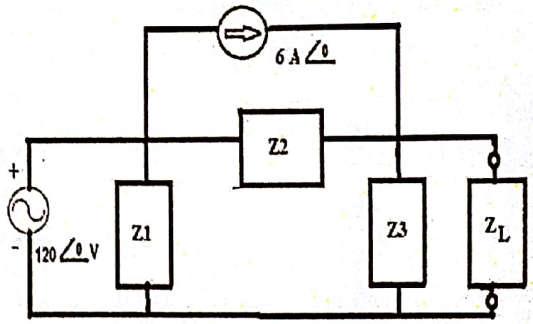
1- Find The value of the series elements. {6 Marks}
2- Complete the phasor diagram . {4 Marks}
3- Determine P_{av} {2 Marks}



Q3)- {15 Marks}

In the circuit shown,given that:
$Z_1 = 3 - J4$, $Z_2 = 4.426 + J4.426$,and
$Z_3 = 2 - J3$

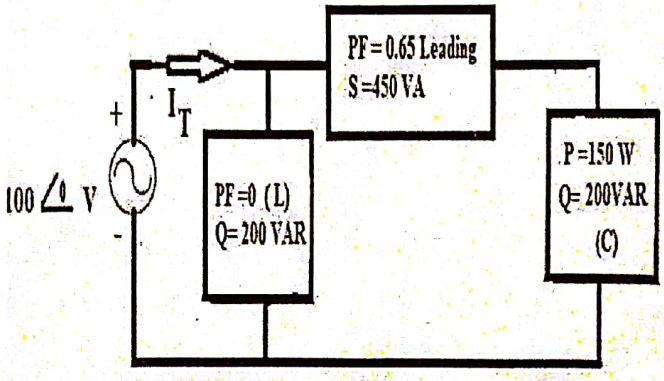
a)- Determine the value of Z_L for maximum power to the load. {6 Marks}
b)-Find P_{max} {9 Marks}



Q4)- {15 Marks}

For the System shown:

a)- Draw the power triangle. {9 Marks}
b)- Find total power factor. {3 Marks}
c)- Determine the total current I_T. {3 Marks}



تمنياتي للجميع بالتوفيق
أساتذة المادة

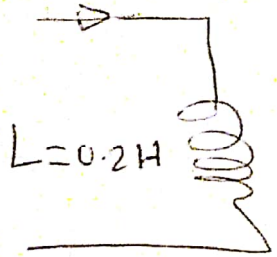
(1)

(2i)- $\omega = 314 \text{ rad/s}$

$\alpha = 90^\circ$

$\alpha = \omega t \Rightarrow t = \frac{\alpha}{\omega} = \frac{90^\circ \times \pi/180^\circ \text{ Rad}}{314 \text{ rad/s}} = 5 \text{ ms}$

(b) $i(t) = 7\sin(377t - 70^\circ)$ A

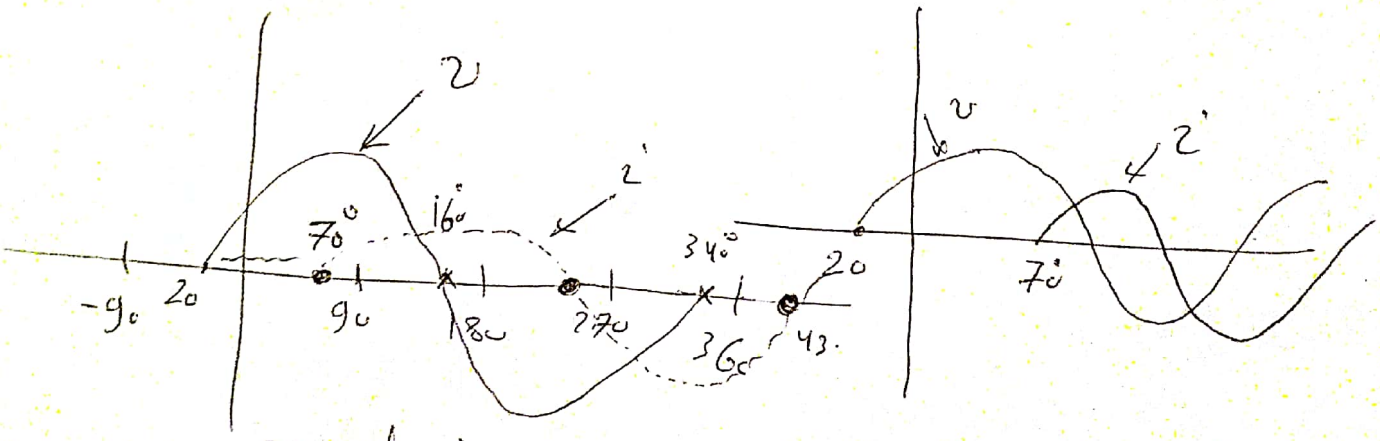


$X_L = \omega L = 377 \times 0.2 = 75.4\ \Omega$

$X_L = \frac{V_m}{I_m}$

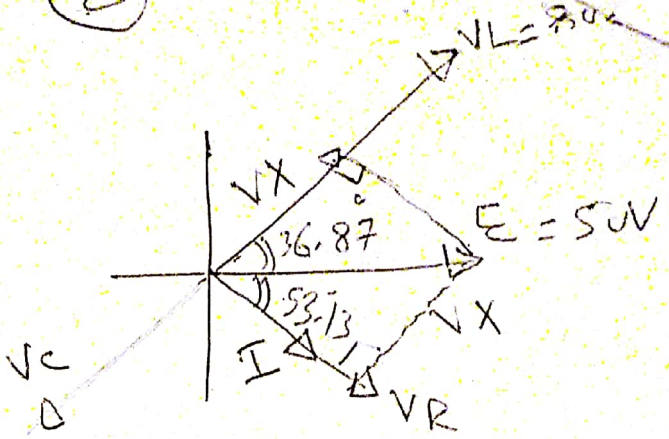
$V_m = I_m X_L = 7 \times 75.4 = 527.8 \text{ V}$

$v(t) = 527.8 \sin(377t + 20^\circ) \text{ V}$



v leads i by 90°

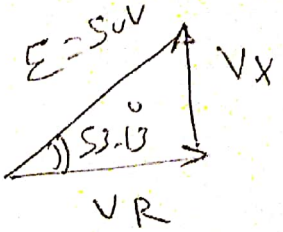
(Q2) –



(1) $\cos\theta = \frac{V_R}{E}$

$V_R = E\cos\theta$

$= 50 \times 0.6 = 30V$



$\sin\theta = \frac{V_X}{E} \Rightarrow V_X = E\sin\theta$

$= 50 \times \sin 53.13^\circ$

$= 40V$

$V_X = V_L - V_C$

$V_C = 80V - 40V = 40V$

$R = \frac{V_R}{I} = \frac{30}{10} = 3\,\Omega$

$X_L = \frac{V_L}{I} = \frac{80}{10} = 8\,\Omega$

$X_C = \frac{V_C}{I} = \frac{40}{10} = 4\,\Omega$

Since $V_L = 80V$

$I = 10A$

$X_L = \frac{80}{10} = 8\,\Omega$

$Z_T = \frac{E}{I} = \frac{50\angle 0^\circ}{10\angle -53.13^\circ}$

$= 5\angle 53.13^\circ = 3 + j4$

$R \quad X_T$

$3 + j4 = R + j8 + \cancel{-jX_C}$

$R = 3\,\Omega \qquad +j4 = +j8 + Z$

$Z = +j4 - j8$

$= -j4 = X_C$

(3) $P_{av} = I^2R = (10)^2 \times 3 = 300W$

$P_{av} = E.I\cos\theta$

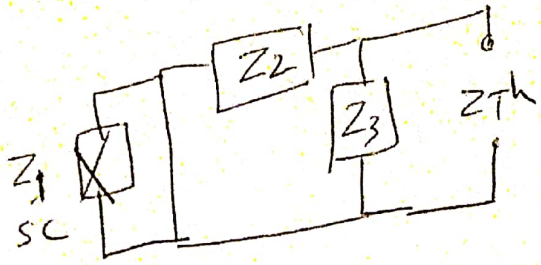
$= 50 \times 10 \times 0.6 = 300W$

(Q3)

$Z_1 = 3 - j4 = 5\angle -53.13^\circ\ \Omega$

$Z_2 = 4.426 + j\,4.426 = 6.2593\angle 45^\circ\ \Omega$

$Z_3 = 2 - j3 = 3.605\angle -56.31^\circ\ \Omega$



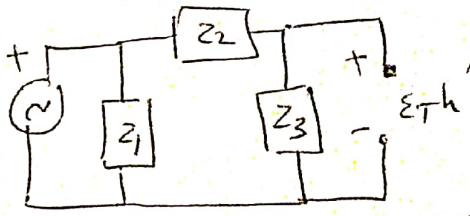
$Z_{Th} = Z_2 // Z_3 = \dfrac{Z_2 Z_3}{Z_2 + Z_3}$

$Z_{Th} = \dfrac{6.2593\angle 45^\circ \times 3.605\angle -56.31^\circ}{6.582\angle 12.511} = 3.428\angle -23.821^\circ\ \Omega$

$= 3.1359 + j\,1.3845$

For max Power to the Load

$Z_L = 3.1359 + j1.3845$



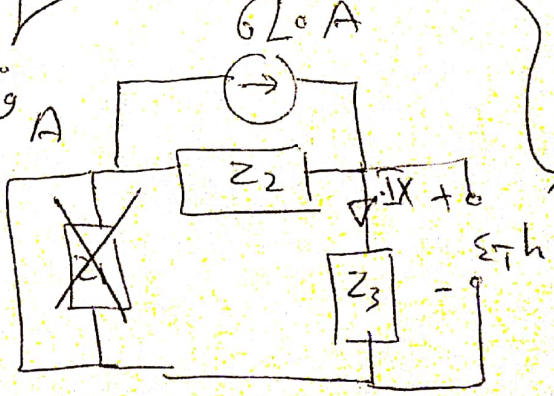
$\mathcal{E}_{Th}' = V_{Z_3} = \dfrac{120\angle 0^\circ \times 3.605\angle -56.31^\circ}{6.582\angle 12.511^\circ}$

$= 65.724\angle -68.641^\circ\ V$

$\boxed{\mathcal{E}_{Th}' = 23.937 - j\,61.226}$

$P_{max} = \dfrac{\mathcal{E}_{Th}^2}{4R_{Th}} = \dfrac{(80.9235)^2}{4 \times 3.1359} = 522.211\ W$

$I_X = \dfrac{6\angle 0^\circ \times 6.259\angle 45^\circ}{6.582\angle 12.511^\circ} = 5.469\angle 32.489^\circ\ A$



$\mathcal{E}_{Th}'' = V_{Z_3} = 5.469\angle 32.489^\circ \times 3.605\angle -56.31^\circ$

$= 19.715\angle -23.82^\circ$

$\boxed{\mathcal{E}_{Th}'' = 18.035 - j\,7.962}$

$\mathcal{E}_{Th} = \mathcal{E}_{Th}' + \mathcal{E}_{Th}'' = 41.972 - j\,69.188 = 80.9235\angle -58.757^\circ\ V$

Q.4)

Load # 1 $P_f = 0$ (L) $S_1 = 0 + j200$

$Q = 200$ VAR

Load # 2

$P_{f2} = 0.65$ Leading $\theta_2 = \cos^{-1} 0.65$

$\theta = 49.458°$

$S_2 = 450$ VA

$S_2 = 450 \angle -49.458°$

$= 292.5 - j341.968$

Load # 3

$P_3 = 1500$ W $S_3 = 150 - j200$

$Q_3 = 200$ VAR (C)

$S_T = (0 + j200) + (292.5 - j341.968) + (150 - j200)$

$= (442.5 - j341.97)$

$= 559.24 \angle -37.63°$ VA

$P_{fT} = \cos 37.63 = 0.792$ Leading.

$S_T = E \cdot I_T^*$

$I_T^* = \frac{S_T}{E} = \frac{559.24 \angle -37.63°}{100 \angle 0°}$

$I_T^* = 5.5924 \angle -37.63°$ A

$I_T = 5.5924 \angle 37.63°$ A