

Q1.  $V_1 = 25 \cos(4000t + 45^\circ - 90^\circ)$   
 $= 25 \cos(4000t - 45^\circ)$   
 $= 25 \angle -45^\circ \rightarrow 17.68 - j17.68$

$V_2 = 72 \cos(4000t + 27^\circ - 90^\circ)$   
 $= 72 \cos(4000t - 63^\circ)$   
 $= 72 \angle -63^\circ \rightarrow 32.69 - j64.15$

$V_3 = 150 \angle -87^\circ \rightarrow 7.85 - j149.79$

$V_4 = 10 \angle -143^\circ \rightarrow -7.99 - j6.02$

$V = V_1 + V_2 + V_3 + V_4$   
 $= 17.68 - j17.68 + 32.69 - j64.15$   
 $+ 7.85 - j149.79 - 7.99 - j6.02$   
 $= 50.23 - j237.64$   
 $= 242.89 \angle -78.07$

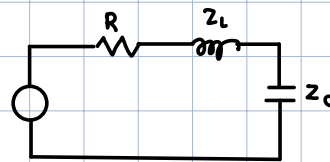
$V = 242.89 \cos(4000t - 78.07^\circ) \text{ V}$

Q2.  $R = 90 \Omega$

$Z_L = j\omega L = j(5000)(32 \times 10^{-3}) = j160 \Omega$

$Z_C = \frac{-j}{\omega C} = \frac{-j}{(5000)(5 \times 10^{-6})} = -j40 \Omega$

$Z_T = R + Z_L + Z_C = 90 + j160 - j40$   
 $= 90 + j120 \rightarrow 150 \angle 53.13^\circ$



$V = 750 \cos(5000t + 30^\circ) \text{ V}$   
 $= 750 \angle 30^\circ$

$V = IZ \rightarrow I = \frac{V}{Z_T} = \frac{750 \angle 30^\circ}{150 \angle 53.13^\circ} = 5 \angle -23.13^\circ$

$i(t) = 5 \cos(5000t - 23.13^\circ) \text{ A}$

Q3.  $\frac{V_1}{N_1} = \frac{V_2}{N_2}$

$N_1 I_1 = N_2 I_2$

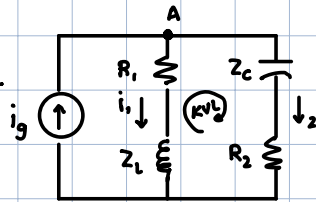
$(5)(1.5 \text{ A}) = (25)I_2$

$\frac{3 \text{ V}}{5} = \frac{V_2}{25}$

$I_2 = 0.3 \text{ A}$

$V_2 = 15 \text{ V}$

Q4.



$$Z_L = j\omega L = j(10000)(10 \times 10^{-3}) = j100 \Omega$$

$$Z_C = \frac{-j}{\omega C} = \frac{-j}{(10000)(2 \times 10^{-6})} = -j50 \Omega$$

$$i_g = 100 \times 10^{-3} \angle 0^\circ$$

$$= 0.1 + j0$$

$$(a) \text{ KVL: } Z_L(i_2 - i_g) + R_1(i_2 - i_g) + Z_C(i_2) + R_2(i_2) = 0$$

$$Z_2 = Z_C + R_2$$

$$i_g(-Z_L - R_1) + i_2(Z_L + R_1 + Z_C + R_2) = 0$$

$$= -j50 + 300 \rightarrow 304.14 \angle -9.46^\circ$$

$$0.1(-j100 - 50) + i_2(j100 + 50 - j50 + 300) = 0$$

$$i_2 = \frac{5 + j10}{350 + j50} = 0.018 + j0.026 \rightarrow 0.032 \angle 55.30^\circ$$

$$V_2 = I_2 Z_2$$

$$V_2 = (0.032 \angle 55.30^\circ)(304.14 \angle -9.46^\circ)$$

$$= 9.73 \angle 45.84^\circ$$

$$V_2 = 9.73 \cos(10000t + 45.84^\circ) \text{ V}$$

$$\text{BRANCH 2: } i_2 = 0.032 \cos(10000t + 55.30^\circ) \text{ A}$$

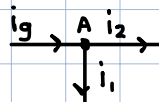
$$i_2 = 32 \cos(10000t + 55.30^\circ) \text{ mA}$$

$$i_g = i_1 + i_2$$

$$i_1 = i_g - i_2$$

$$= 0.1 - (0.018 + j0.026)$$

$$= 0.082 - j0.026 \rightarrow 0.086 \angle -17.59^\circ$$



$$\text{BRANCH 1: } i_1 = 0.086 \cos(10000t - 17.59^\circ) \text{ A}$$

$$i_1 = 86 \cos(10000t - 17.59^\circ) \text{ mA}$$

$$Z_1 = R_1 + Z_L$$

$$= 50 + j100 = 111.80 \angle 63.43^\circ$$

$$V_1 = I_1 Z_1$$

$$= (0.086 \angle -17.59^\circ)(111.80 \angle 63.43^\circ)$$

$$= 9.615 \angle 45.84^\circ$$

$$V_1 = 9.615 \cos(10000t + 45.84^\circ) \text{ V}$$

$$(b.) S_2 = \frac{1}{2} (9.73 \angle 45.84^\circ) (0.032 \angle -55.30^\circ)$$

$$= 0.156 \angle -9.46^\circ$$

$$S_2 = 0.153 - j0.0256 \text{ VA}$$

$$S = \frac{1}{2} V I^*$$

$$P = \frac{1}{2} V_m I_m \cos(\theta_V - \theta_I)$$

$$Q = \frac{1}{2} V_m I_m \sin(\theta_V - \theta_I)$$

$$|S| = \sqrt{P^2 + Q^2}$$

$$(c) P_{avg} = \frac{(9.73)(0.032)}{2} \cos(45.84^\circ - 55.30^\circ) = 0.153 \text{ W}$$

$$Q = \frac{(9.73)(0.032)}{2} \sin(45.84^\circ - 55.30^\circ) = -0.0256 \text{ VAR}$$

$$S = \sqrt{(0.153)^2 + (-0.0256)^2} = 0.156 \text{ VA}$$