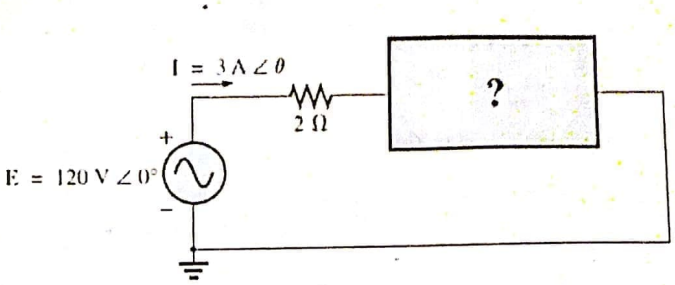
Answer all the questions

Q1A- 6 درجات

Find the series element or elements in the circuit shown that must be in the enclosed container to satisfy the following conditions.

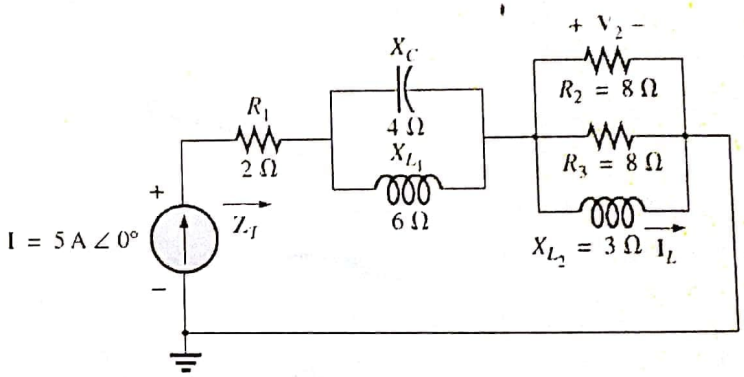
a- Average power of the circuit is = 300 W
b- The circuit has a lagging power factor



Q1B- 9 درجات

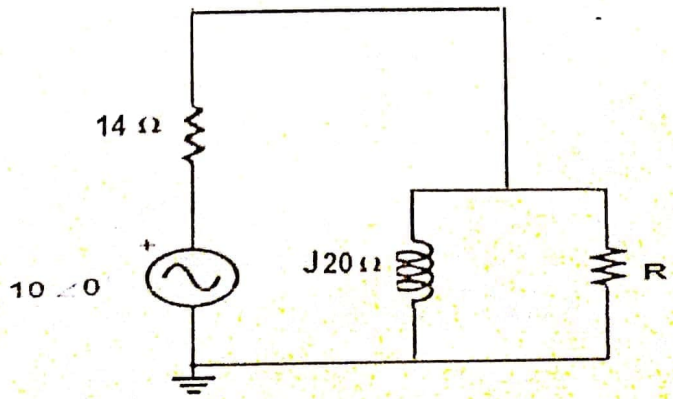
For the network circuit shown Find

a) The current I_L.
b) Voltage V2.
c) The average power delivered to the network.



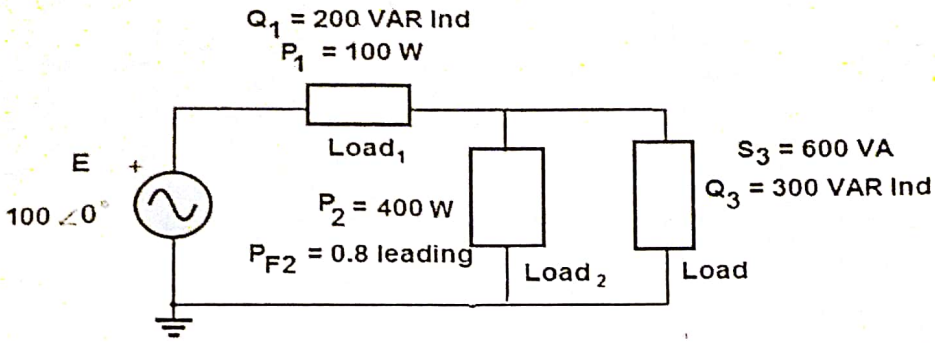
Q2- 15 درجة

For the circuit shown , find the value of R to produce maximum power in the 14 Ω resistor, Calculate the value of this maximum power Pmax



Q3- [15 درجة]

The Circuit shown consists of three loads in a series - parallel connection , with each of the load is deified as indicted. Find the overall complex power of the circuit , its overall P_F, and the phasor from of the source current I



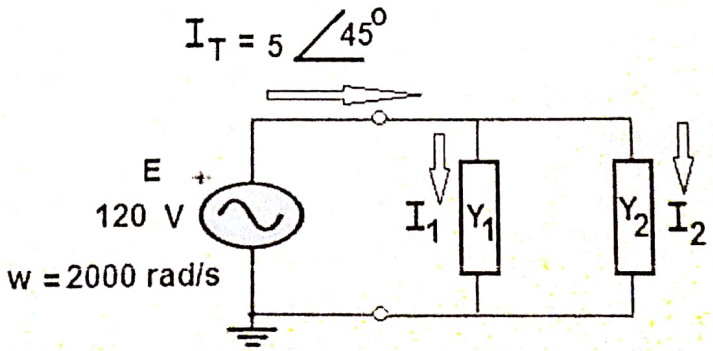
Q4A [8 درجات]

If A series resonant circuit will resonate at a frequency of 1 MHz with a fractional bandwidth of 0.2 Hz the quality factor of the coil at resonance is 12.5 and its inductance is 100 mH, determine the following:

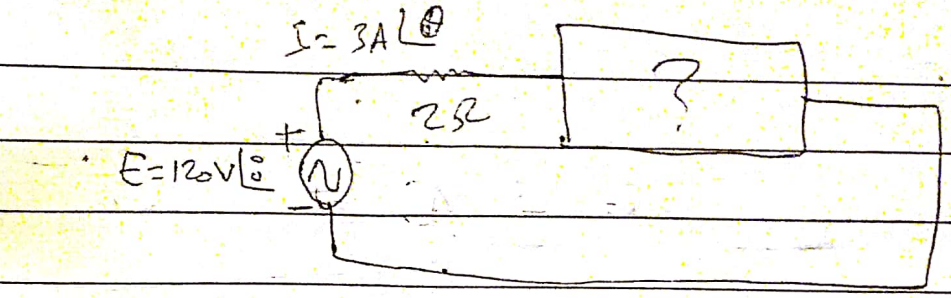
a. The resistance of the coil.
b. The required value of capacitance

Q4B- [7 درجات]

Y1 and Y2 Contain a single element each. The current I1 is in phase with E and equal to 6A. The source voltage E leads I_T. Find the value of each element



Q1A



$P = IV\cos\theta$

$300 = (3)(120)\cos\theta$

$\cos\theta = \frac{300}{(3)(120)} = 0.833$

$\theta = \cos^{-1} 0.833 = 33.59^\circ$

$\theta = 33.59^\circ$

$V = 120V\angle 0^\circ$, $I = 3A\angle -33.59^\circ$

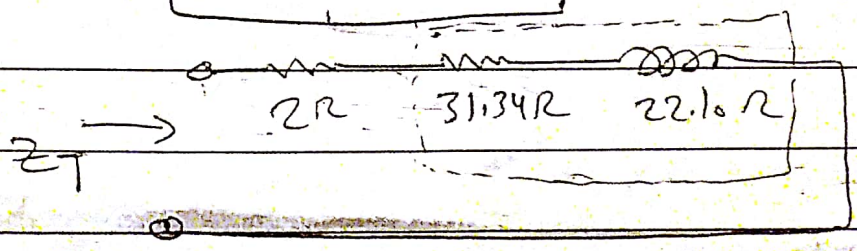
$Z_T = \frac{V}{I} = \frac{120\angle 0^\circ}{3\angle -33.59^\circ} = 40\Omega\angle 33.59^\circ$

$Z_T = 40\Omega\angle 33.59^\circ = 33.34 + j22.10\Omega$

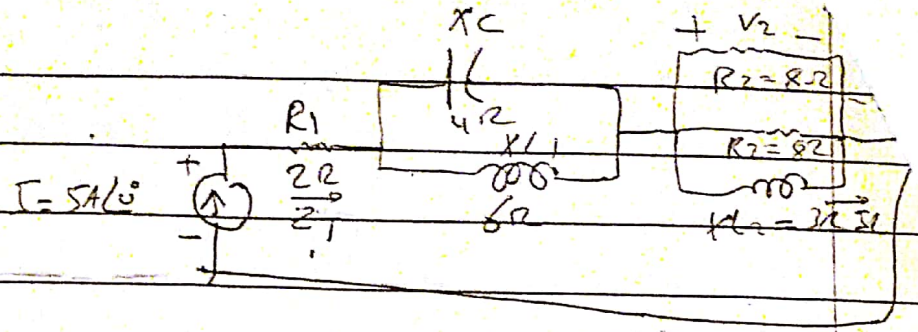
$R_T = 33.34\Omega = 2\Omega + R$

$R = 33.34 - 2 = 31.34\Omega$

$R = 31.34\Omega$



Q1 B



$$Z_T = 2\Omega + \frac{(4\angle -90^\circ)(6\angle 90^\circ)}{-j4+j6} + \frac{(4\angle 0^\circ)(3\angle 90^\circ)}{4+j3}$$

$$= 2 + \frac{24\angle 0^\circ}{2\angle 90^\circ} + \frac{12\angle 90^\circ}{5\angle 36.87^\circ}$$

$$= 2 + 12\angle -90^\circ + 2.4\angle 53.13^\circ$$

$$Z_T = 3.44\Omega - j10.8\Omega$$

$$Z_T = 10.65\Omega \angle -71.16^\circ$$

$$V_2 = 2.4\angle 53.13 \; I = 2.4\angle 53.13 \times 5\angle 0^\circ$$

$$V_2 = 12\angle 53.13 \; V$$

$$I_L = \frac{(4\angle 0)I}{4+j3} = \frac{(4\angle 0)(5\angle 0^\circ)}{5\angle 36.87^\circ} = 4A\angle -36.87^\circ$$

$$I_L = 4\angle -36.87^\circ$$

$$FP = \frac{R}{Z_T} = \frac{3.44}{10.65} = 0.323 \text{ (leading)}$$

$$P = EI\cos\theta$$

$$P = 53.25 \times 5 \times \cos(-71.16) = 53.25 \times 5 \times 0.323$$

$$P = 85.97 W$$

$\therefore S = 1039 = EI$

$\therefore I = \frac{1039}{100} = 10.39\ A$

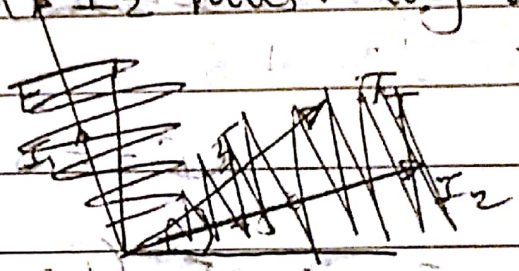
since its inductive load $\Rightarrow$ that E lead I

$\therefore I = 10.39 \angle -11.1^\circ\ A.$

A4B

Since I_1 in Y_1 is in phase with E $\Rightarrow Y_1$ is R

$\therefore$ E lead $I_T \Rightarrow$ CKT is inductive $\therefore Y_2$ must be inductor then I_2 must lag E by 90°



$I_T^2 = I_1^2 + I_2^2$

$I_2 = \sqrt{5^2 - 3^2} = 4A$

$R = \frac{E}{I_1} = \frac{120}{3} = 40\Omega$

$X_L = \frac{E}{I_2} = \frac{120}{4} = 30\Omega = \omega L$

$\therefore L = \frac{30}{3000} = 10\ mH$

$E = 120 \angle 45^\circ + 53.1^\circ = 120 \angle 98.1^\circ V$

A2 (25)

To find the max power

$P_{14\Omega} = P_{max} = I^2(14)$

but $I = \frac{E}{Z_T} = \frac{10\angle 0^\circ}{Z_T}$

and $Z_T = 14 + \frac{19.6(j20)}{19.6+j20} = \frac{392\angle 90^\circ}{28\angle 45.58^\circ}$

$Z_T = 14\angle 44.42^\circ$

$I = \frac{10\angle 0^\circ}{14\angle 44.42^\circ} = 0.714\angle -44.42^\circ$

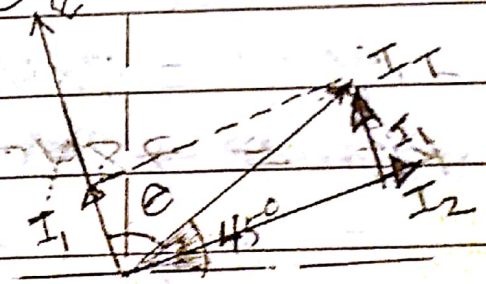
$P_{max} = (0.714)^2(14) = 9.99 \approx 10$ Watt

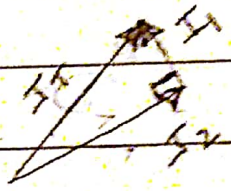
---

(25) Phasor diagram for Φ_{4B}

E lead I_T by θ

E lead I_2 by 90°





from figure

$I_1 = I_T \cos\theta$

$\therefore \cos\theta = \frac{I_1}{I_T} = \frac{3}{5} = 0.6$

$I_1^2 + I_2^2 = I_T^2$

$\therefore \theta = 53.1^\circ$

Q3

$S = S_1 + S_2 + S_3$

$S_1 = 100 + j200 = 223.6\angle 63.4°$ VA

For load 2

$PF_2 = 0.8$ leading, mean capacitive load

$= \frac{P_2}{S_2} = \cos\theta_2$

$\therefore |S_2| = \frac{P_2}{PF_2} = \frac{400}{0.8} = 500$ VA

$\therefore \theta_2 = -36.9°$

Thus

$S_2 = 500\angle -36.9°$ VA $= 400 - j300$ VA

For load 3

$Q_3 = S_3 \sin\theta_3$

$\sin\theta_3 = \frac{Q_3}{S_3} = \frac{300}{600} = 0.5$

$\therefore \theta_3 = 30° \Rightarrow$ inductive load

$S_3 = 600\angle 30° = 519.6 + j300$ VA

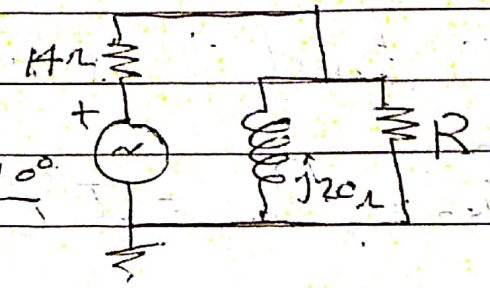
$\therefore S = (100 + j200) + (400 - j300) + (519.6 + j300)$

$= 1019.6 + j200 = 1039\angle 11.1°$ VA

The overall load is inductive with

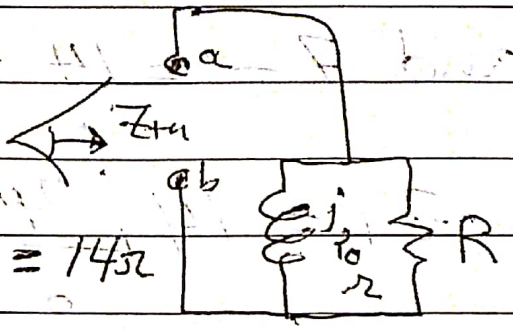
$PF = \cos 11.1° = 0.981$ lagging.

Q2)



TO Transfer Max. power to 14Ω We need to find Thevinen circuit out of 14Ω as follow

$$Z_{th} = \frac{j20 \times R}{R + j20}$$



$$\left|\frac{j20R}{R+j20}\right| = \frac{20R}{\sqrt{R^2+400}} = 14\Omega$$

Z_{th} must equal to 14Ω to insure a max. power transfer : square both sides

$$\frac{400R^2}{R^2+400} = 196$$

$$196(R^2+400) = 400R^2$$

$$196R^2 + 78400 = 400R^2$$

$$400R^2 - 196R^2 = 78400$$

$$204R^2 = 78400$$

$$R^2 = \frac{78400}{204} = 384.31\Omega$$

$$\therefore R = \sqrt{384.31} = 19.6\Omega$$

a) $Q_L = \frac{X_L}{R_L} \Rightarrow R_L = \frac{X_L}{Q_L} = \frac{2\pi f L}{Q_L}$

$$R_L = \frac{2\pi (1\times10^6)\times100\times10^{-3}}{12.5} = 50.27\,k\Omega$$

$$\frac{f_2 - f_1}{f_s} = \frac{1}{Q_s} = 0.2$$

$$Q_s = \frac{1}{0.2} = 5 = \frac{X_L}{R} = \frac{2\pi f L}{R} = \frac{2\pi\times1\times10^6\times100\times10^{-3}}{R}$$

$$R = \frac{628.32\times10^3}{5} = 125.66\,k\Omega$$

$$R = R_d + R_L$$

$$125.66\,k\Omega = R_d + 50.27\,k\Omega$$

$$R_d = 125.66\,k\Omega - 50.27\,k\Omega$$

$$\boxed{R_d = 75.39\,k\Omega}$$

b) $$X_C = \frac{1}{2\pi f C} = X_L$$

$$C = \frac{1}{2\pi f X_C} = \frac{1}{2\pi\times1\times10^6\times628.32\times10^3}$$

$$\boxed{C = 253.3\,nF}$$

Q1)- {15 Marks}

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

$\alpha = \omega t \quad \frac{\pi}{2} = \frac{314 \times \pi}{180} t$

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}**

$$i(t) = 7 \sin(377t - 70°)$$

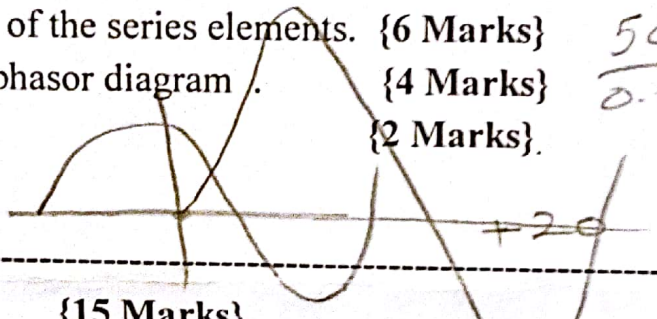
Q2)- **{15 Marks}**

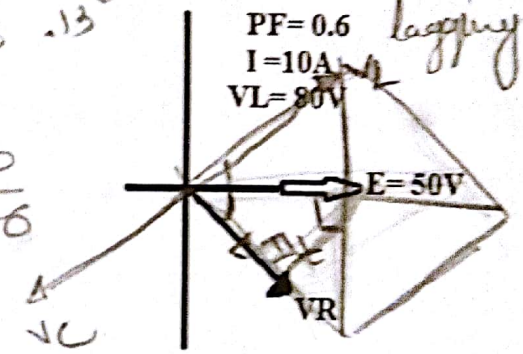
The phasor diagram of Series RLC circuit is shown in the fig:

1- Find The value of the series elements. **{6 Marks}**

2- Complete the phasor diagram . **{4 Marks}**

3- Determine P_{av} **{2 Marks}**





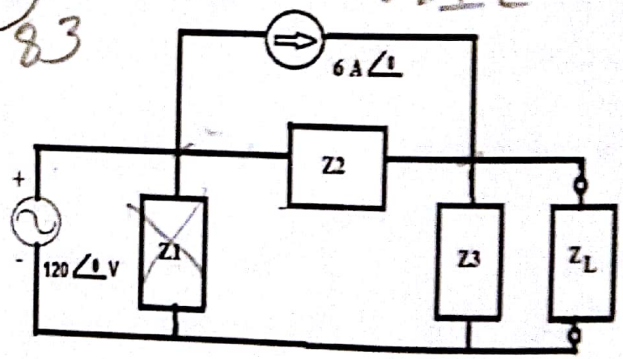
Q3)- **{15 Marks}**

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}**



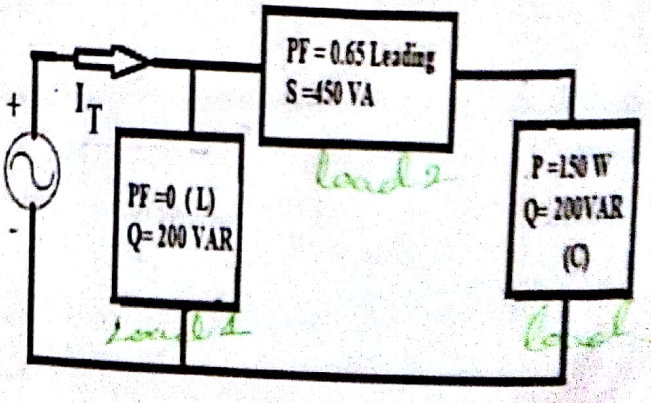
Q4)- **{15 Marks}**

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