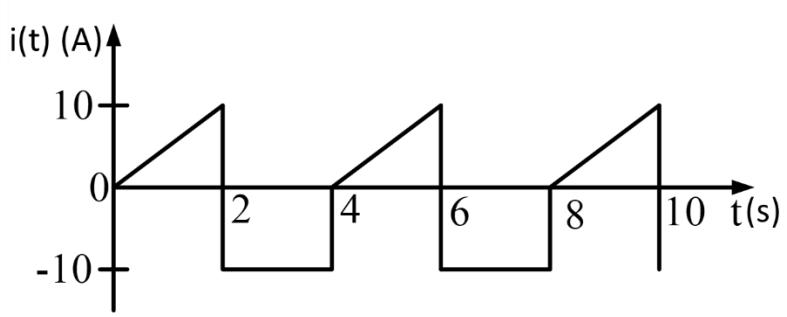
Basic Electrical Engineering Tutorial Sheet -2

Q1. (a) Determine the rms value (I_{rms}) of current waveform. If the current is passed through 5Ω resistor, find the average power (P_{avg}) absorbed by the resistor.

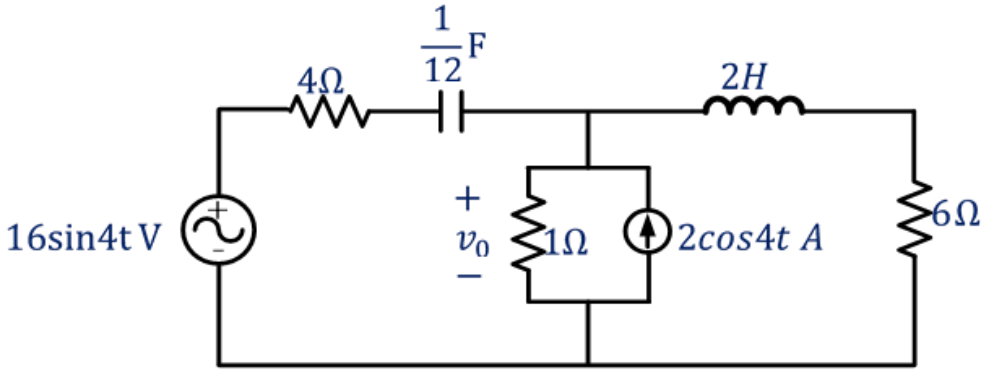
[I_{rms} = 8.17A, P_{avg} = 333.37W]



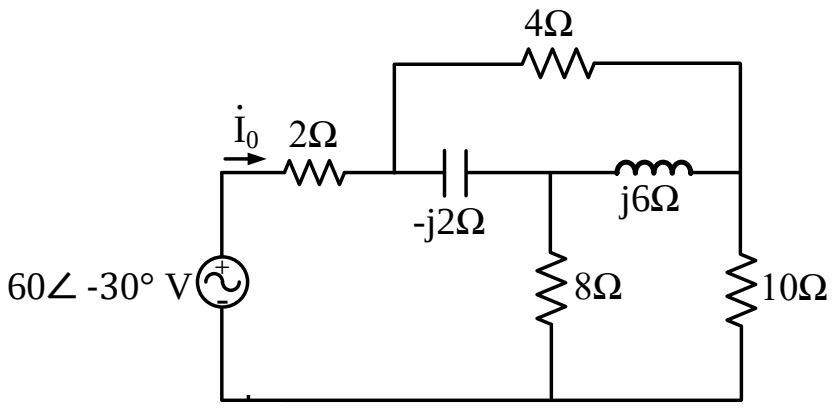
(b) Find the rms value of the voltage v(t)= 20sin(8t) + 40cos(8t+45°) V. [20.84 V]

(c) Calculate the rms value of the signal i(t)= 8 cos 15*t* + 21 sin 32*t* + 9 A. [I_{rms}=18.26 A]

Q2. Determine v_0 (t) in the circuit. [v_0(t)=3.835 cos(4t-35.02^0) V]

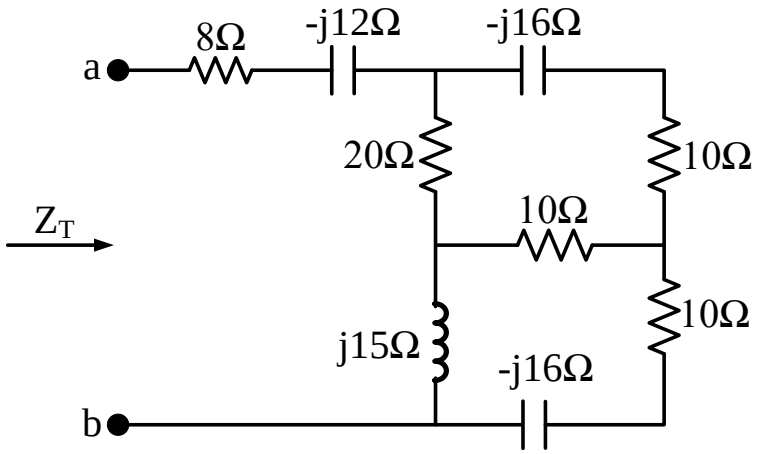


Q3. Find the current phasor $\dot{I}_0$ in the circuit. [$\dot{I}_0 = 8.87\angle -21.67°A$]



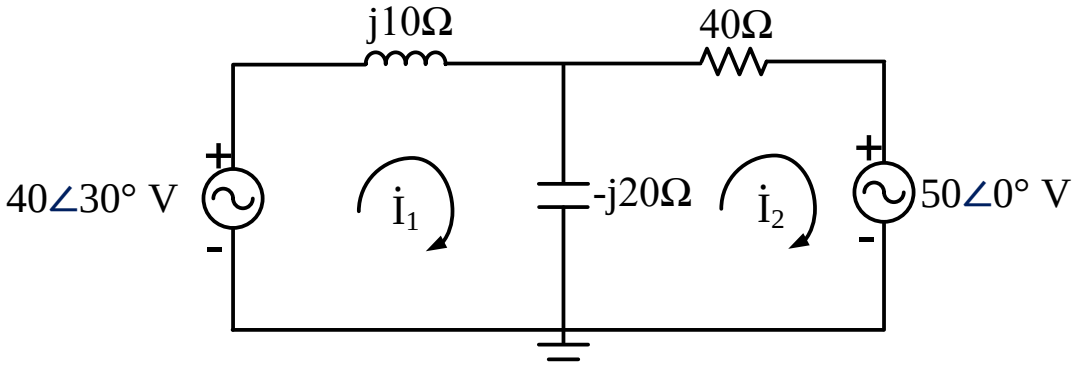
Q4. Find the value of Z_T across terminals ab in the circuit.

$[Z_T = 35.38\angle -11.3° \Omega]$

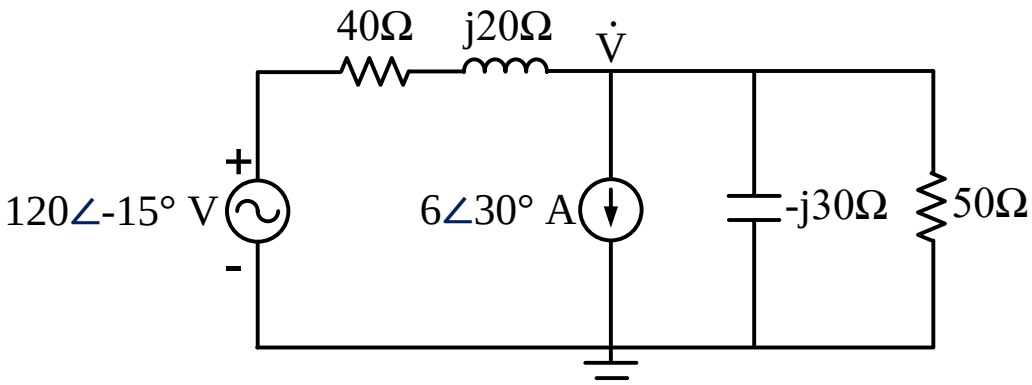


Q5. Find $\dot{I}_1$ and $\dot{I}_2$ in the circuit using the mesh current method.

$[\dot{I}_1 = 4.698\angle 95.24° A$ and $\dot{I}_2 = 0.993\angle 37.71° A$]

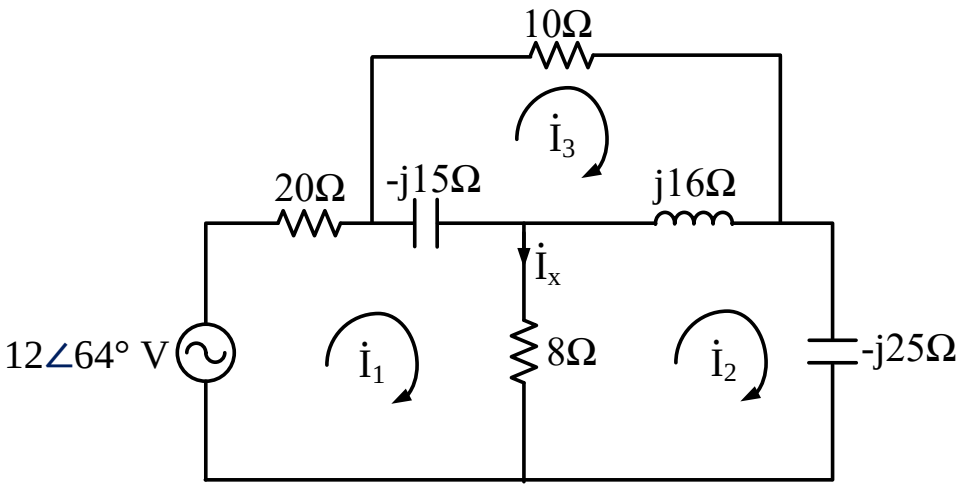


Q6. Find $\dot{V}$ for the circuit using nodal voltage method. [$\dot{V}$=124.08∠-154° V]

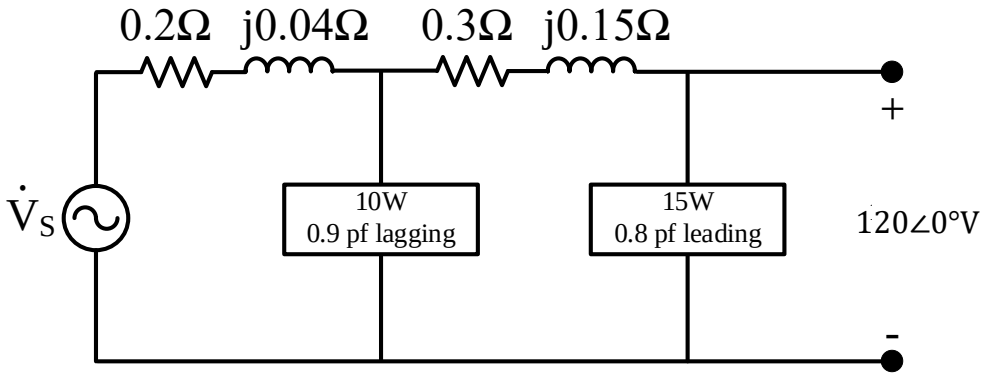


Q7. Find $\dot{I}_1, \dot{I}_2, \dot{I}_3, and\ \dot{I}_x$ in the circuit using the mesh current method .

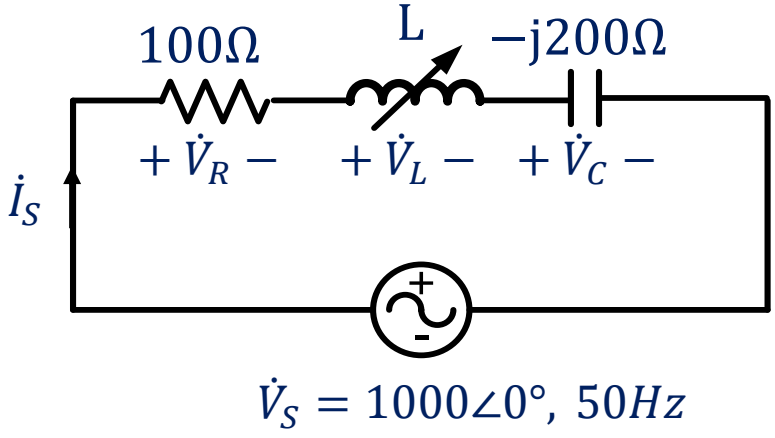
$[\dot{I}_1 = 0.381\angle 109.6°A,\ \dot{I}_2 = 0.34\angle 124.4°A,\ \dot{I}_3 = 0.145\angle -60.42°A, and\ \dot{I}_x = 0.1\angle -48.5°A]$



8. For the circuit, find the voltage phasor $\dot{V}_S$. $[\dot{V}_S = 120.06\angle 0.03°\ V\ ]$



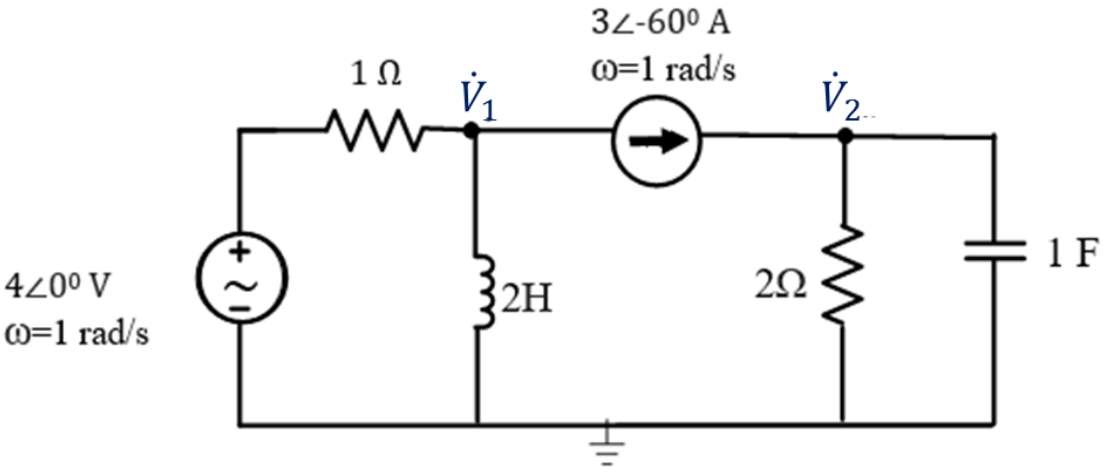
Q9. In a series RLC circuit, L is varied to produce resonance keeping the supply frequency and C fixed. The circuit contains R = 100Ω, the capacitive reactance X_C = 200Ω, f = 50Hz and the supply is 1000 V. Find the voltage drop across L and corresponding value of L (a) at resonance and (b) also when the drop across L is a maximum. [2000 V, 0.6369H, 2236.07 V, 0.7962 H]



Q10. Using nodal voltage method, find $\dot{V}_1$ and $\dot{V}_2$ for the circuit shown. Find also the complex power delivered by each source. Determine the value of the reactance to be connected across the voltage source so that no reactive power is supplied/received by the source.

$[\dot{V}_1 = 3.225\angle 72.667°\ V,\ \dot{V}_2 = 2.6833\angle -123.435°\ V$

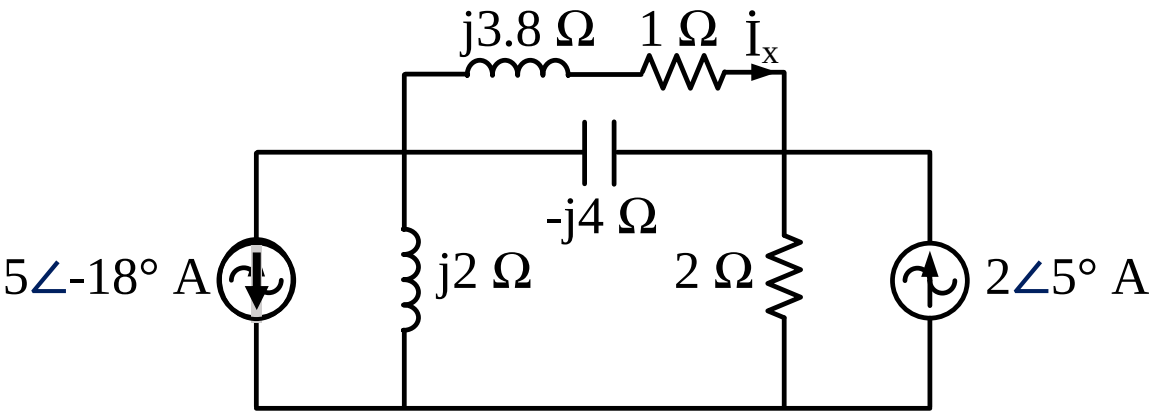
$voltage\ source\ 12.157 + j12.314\ VA\ \ current\ source, 10.157\ -j14.314\ VA\ \ X = -1.3\Omega]$



Q11. When superposition is used on the circuit, find $\dot{I}_x$ with

(a) Only the $5\angle -18°$ A source operating
(b) Only the $2\angle 5°$ A source operating
(c) With both sources operating.

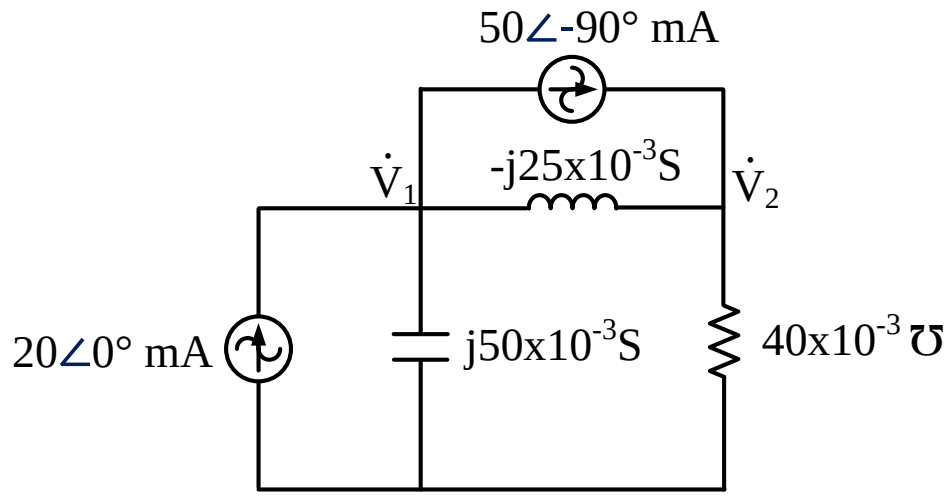
[$2.25\angle 169.77°$ A , $0.9\angle 102.765°$ A, $2.73\angle 152.1°$ A]



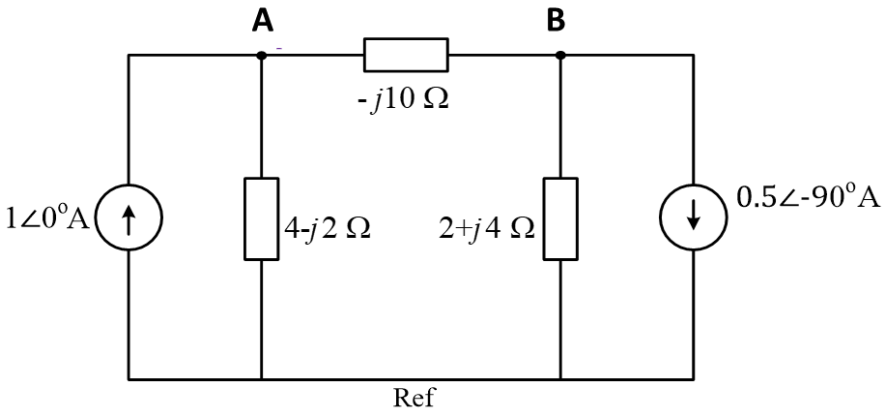
Q12. If superposition is used on the circuit find $\dot{V}_1$ with

(a) Only the $20\angle 0°$ mA source operating

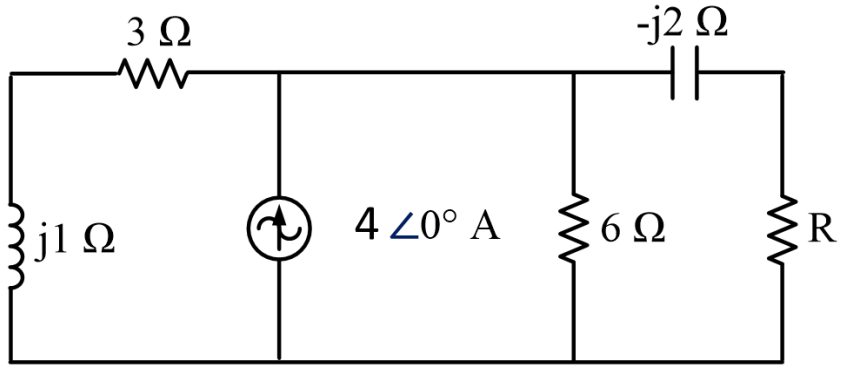
(b) Only the $50\angle -90°$ mA source operating. [0.1951-j0.556 V, 0.780 + j 0.796 V]



Q13. Obtain the Thevenin equivalent as seen by –j10 Ω impedance in the circuit and then the node A voltage phasor (V_A). [V_{Th}= 6 − *j*3 V, Z_{Th} = 6 + *j*2 Ω V_A=1-j2 V]

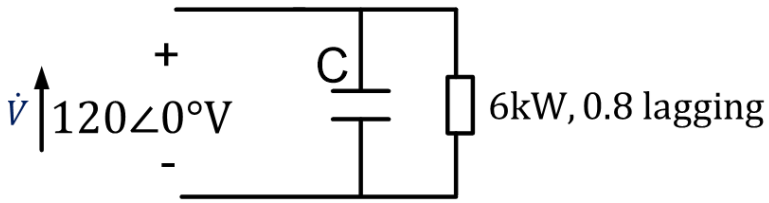


Q14. Find the suitable value of R which absorbs maximum power from the circuit and the corresponding maximum power. [R = 2.576 Ω, Pmax = 7.62 W]



Q15 . Connected to 100V, 50Hz supply, a load absorbs 6kW at a power factor of 0.8 lagging. Find the capacitance to be connected in parallel to raise the combined power factor to unity.

[C = $1.433mF$]



Q16. A load of impedance Z = $10\angle 45^0\ \Omega$ is connected to a source of $100\angle 0^0$ V, 50 Hz. A power factor improvement capacitor C is connected across the load as shown which contributes a reactive power of 500 var. What will be the power factor of the combination of C and the load? [0.96 lagging]