Q- A sinusoidal voltage v (t) = (40.0 V) sin (100t) is applied to a series RLC circuit with L = 160mH, C = 0.9 μF, and R = 68 Ohm

a) What is the impedance of the circuit?

As indicated by the equation V_{max} = 40.0 V and ω = 100 radians/sec.

Hence the inductive reactance of the circuit will be

$X_L = L\omega = 160*10^{-3}*100 = 16\ \Omega$

And the capacitive reactance will be

$XC = 1/(C\omega) = 1/(0.9*10^{-6}*100) = 1.11*10^4\ \Omega$

Now the impedance of the circuit is given by

$$Z = \sqrt{R^2 + \left(X_L - X_C\right)^2}$$

Or $$Z = \sqrt{68^2 + \left(16 - 1.11*10^4\right)^2} = 11084.21\Omega$$

(b) What is the maximum current?

The peak value of voltage (maximum) is 40V and hence maximum current in the circuit is given by

$I_{max} = V_{max}/Z$
$= 40.0/11084.21 = 3.61*10^{-3}$ A

(c) Determine Phase angle in the equation i (t) = I_{max} sin (ωt – Phase angle) and the average power in the circuit.

The maximum current is already calculated and equal to 3.61 mA

The phase angle is given by

$$\tan\phi = \frac{\left(X_L - X_C\right)}{R} = \frac{-11084}{68} = -163$$

Gives ϕ = - 89.65^0

The average power in the LCR circuit is given by

$$\langle P \rangle = \frac{i_{max}^2 R}{2} = \frac{\left(3.61*10^{-3}\right)^2 * 68}{2} = 4.43*10^{-4}\ \text{W}$$