

# NCERT Physics 12.7 Q19

EE23BTECH11212 - MANUGUNTA MEGHANA SAI\*

**Question:** Suppose the circuit in Exercise 7.18 has a resistance of  $15\ \Omega$ . Obtain the average power transferred to each element of the circuit, and the total power absorbed.

**Solution:** In Exercise 7.18, the following information is provided:

Description	Symbol	Value
Inductance	L	80 mH
Capacitance	C	$60\ \mu\text{F}$
Resistance	R	$15\ \Omega$
Voltage	V	230 V
Frequencny	f	50 Hz

TABLE I  
IMPEDANCES

Angular frequency of signal,  $\omega = 2\pi f = 2\pi \cdot (50)$   
 $= 100\pi$

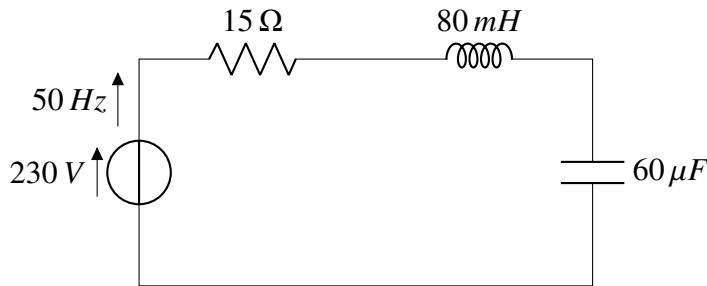


Fig. 1. LCR Circuit

The elements are connected in series to each other. Hence the impedance  $Z$  is given as :

$$Z = \sqrt{R^2 + \left( \omega \cdot L - \frac{1}{\omega \cdot C} \right)^2} \quad (1)$$

$$= \sqrt{15^2 + \left( 100\pi \cdot (80 \times 10^{-3}) - \frac{1}{100\pi \times 60 \times 10^{-6}} \right)^2} \quad (2)$$

$$= \sqrt{15^2 + (25.12 - 53.08)^2} \quad (3)$$

$$= 31.728\ \Omega \quad (4)$$

Current flowing through the circuit  $I$  is :

$$I = \frac{V}{Z} = \frac{230}{31.728} \quad (5)$$

$$= 7.25\ \text{A} \quad (6)$$

Average power transferred to resistance is given by :

$$P_R = I^2 \cdot R = (7.25)^2 \times 15 \quad (7)$$

$$= 788.44\ \text{W} \quad (8)$$

Average power transferred to the capacitor,  $P_C =$   
 Average power transferred to the inductor,  $P_L = 0$

Total power absorbed by circuit:

$$= P_R + P_C + P_L \quad (9)$$

$$= 788.44 + 0 + 0 \quad (10)$$

$$= 788.44\ \text{W} \quad (11)$$

Total power absorbed by circuit is 788.44W