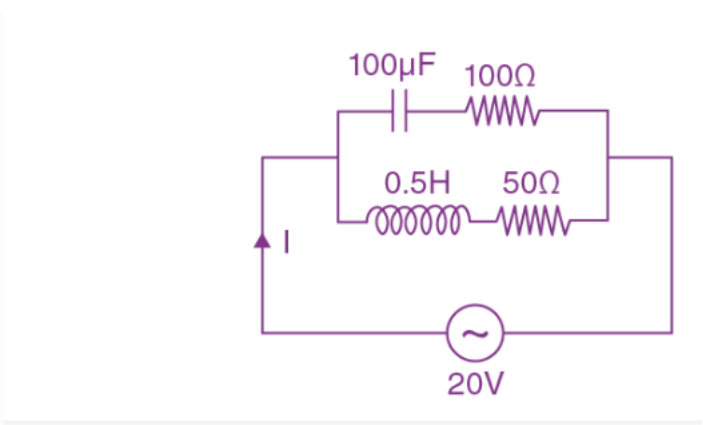
Question 6) In the given circuit, the AC source has ω = 100 rad/s. Considering the inductor and capacitor to be ideal, the correct choice (s) is(are)



(A) The current through the circuit, I is 0.3 A.

(B) The current through the circuit, is 0.3 √2A

(C) The voltage across 100Ω resistor 10√2 V

(D) The voltage across 50Ω resistor 10 V

Solution:

In the upper branch the net impedance, (C = 100μF, R = 100Ω)

Therefore, the net impedance will be

$$Z_1 = \sqrt{\frac{1}{(\omega C)^2} + R^2}$$

$$Z_1 = \sqrt{\frac{1}{(100\times100\times10^{-6})^2} + 100^2}$$

= 100√2

Current $I_1 = V/Z_1 = 20/(100\sqrt{2})$

$\cos \Phi_1 = R/(100\sqrt{2})$

$= 100/(100\sqrt{2})$

$= 1/\sqrt{2}$

$\Rightarrow \Phi_1 = 45^0$

In the lower branch the net impedance (L = 0.5 H, R = 50 Ω)

Therefore, the net impedance will be

$$Z_2 = \sqrt{(\omega L)^2 + R^2}$$

$$Z_2 = \sqrt{(0.5 \times 100)^2 + 100^2}$$

= 50√2

Current, $I_2 = V/Z_2$

$= 20/(50\sqrt{2})$

$\cos \Phi_1 = R/(50\sqrt{2})$

$= 50/(50\sqrt{2})$

$= 1/\sqrt{2}$

$\Rightarrow \Phi_1 = 45^0$

Thus the total current I is given by the summation of I_1 and I_2 which differ by 90^0 in phase and hence

$$I = \sqrt{I_1^2 + I_2^2}$$

= (1/√10) A ≈ 0.3 A

Voltage across 100 Ω = I_1R_1 = [20/(100√2)] x 100 = 10√2 V

Voltage across 50 Ω = I_2R_2 = [20/(50√2)] x 50 = 10√2 V