# GATE 2022 33.BM

EE23BTECH11012 - Chavan Dinesh*

***Question:*** A series RLC circuit with $R = 10\Omega$, $L = 50mH$ and $C = 100\mu F$ connected to 200 V, 50 Hz supply consumes power P. The value of L is changed such that this circuit consumes same power P but operates with lagging power factor. The new value of L is _____ mH (rounded off to two decimal places). (GATE 33 BM 2022)

**Solution:**

| Parameter | Description | Value |
|---|---|---|
| R | Resistance | $10\omega$ |
| C | Capacitance | $100\mu F$ |
| L | Inductor | $50mH$ |
| Z | Impedance | |
| $Z_{new}$ | New Impedance | |

TABLE 1

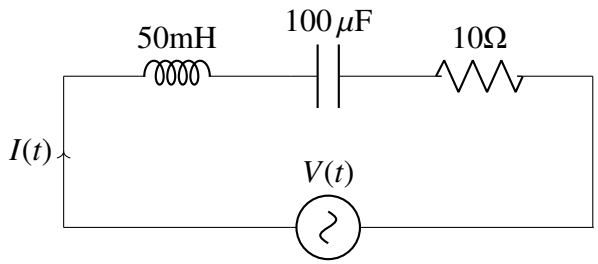


Fig. 1

From Fig. 1

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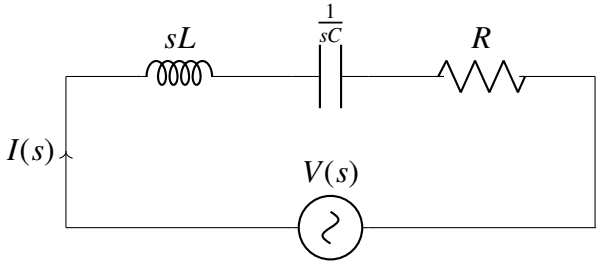


$$Z = R + j(X_l - X_c) \tag{1}$$

$$Z = R + j\left(2\pi fL - \frac{1}{2\pi fC}\right) \tag{2}$$

From Table 1:

$$Z = 10 - 16.123j \tag{3}$$

As the circuit consumes same power P but operates with lagging power factor :
The new impedance($Z_{new}$) will be :

$$Z_{new} = 10 + 16.123j = R + j\left(2\pi fL_{new} - \frac{1}{2\pi fC}\right) \tag{4}$$

Comparing the imaginary parts of the $Z_{new}$:

$$L_{new} \approx 152.7\text{mH} \tag{5}$$