GATE 2022 EE

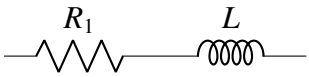
EE23BTECH11023-ABHIGNYA GOGULA

Question27:

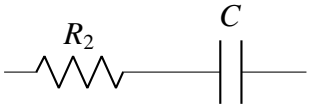
An inductor having a Q-factor of 60 is connected in series with a capacitor having a Q-factor of 240. The overall Q-factor of the circuit is _____. (Round off to the nearest integer)

Gate 2022 EE Question 27

Solution



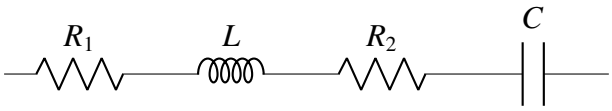
$$Q_1 = \frac{\omega_0 L}{R_1} \tag{1}$$



$$Q_2 = \frac{1}{\omega_0 C R_2} \tag{2}$$

at resonance as $\omega_0 L = \frac{1}{\omega_0 C}$ hence

$$Q_2 = \frac{\omega_0 L}{R_2} \tag{3}$$



$$Q = \frac{\omega_0 L}{R_1 + R_2} \tag{4}$$

$$Q = \frac{1}{\frac{R_1}{\omega_0 L} + \frac{R_2}{\omega_0 L}} \tag{5}$$

$$Q = \frac{Q_1 Q_2}{Q_1 + Q_2} \tag{6}$$

then from (6)

$$Q = \frac{60 \times 240}{60 + 240} \tag{7}$$

$$Q = 48 \tag{8}$$