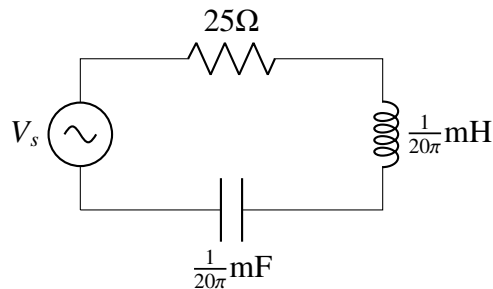


Gate Assignment

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Question

The voltage source $V_s = 10\sqrt{2}\sin(20000\pi t)$ V has an internal resistance of 50 ohms. The RMS value of the current through R is ___ (in mA) (rounded off to one decimal place).



(GATE IN 2023)

Solution:

Parameter	Value
V_s	$10\sqrt{2}\sin(20000\pi t)$ V
R	??
R_{internal}	50 ohms

TABLE I

INPUT PARAMETERS

$$V_s = 10\sqrt{2}\sin(20000\pi t) \text{ volts} \quad (1)$$

$$R_{\text{internal}} = 50 \text{ ohms} \quad (2)$$

$$R = 25 \text{ ohms} \quad (3)$$

$$Z = R + R_{\text{internal}} + Ls + \frac{1}{Cs} \quad (4)$$

$$= 50 + 25 + \frac{s}{20000\pi} + \frac{20000\pi}{s} \quad (5)$$

$$s = \omega j \quad (6)$$

$$= 75 + \frac{20000\pi j}{20000\pi} + \frac{20000\pi}{20000\pi j} \quad (7)$$

$$= 75 + j - j \quad (8)$$

$$= 75 \quad (9)$$

$$I_{\text{RMS}} = \frac{V_{\text{RMS}}}{Z} \quad (10)$$

$$V_{\text{RMS}} = \frac{10\sqrt{2}}{\sqrt{2}} = 10 \text{ volts} \quad (11)$$

$$I_{\text{RMS}} = \frac{10}{75} \times 1000 = \frac{2000}{15} \approx 133.3 \text{ mA} \quad (12)$$