

# GATE 2022 IN 60

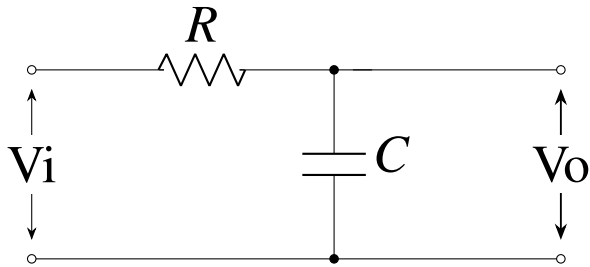
EE23BTECH11213 - MUTHYALA NIKHITHA SRI

**Question:** A 1kHz sine wave generator having an internal resistance of  $50\Omega$  generates an open-circuit voltage of  $10V_p$ . When a capacitor is connected across the output terminals, the voltage drops to  $8V_p$ . The capacitance of the capacitor (in microfarads) is (GATE IN 2022)

**Solution:**

Parameter	Description	Value
$V_i$	Input voltage	$10V_p$
$V_o$	Output voltage	$8V_p$
$R$	Internal resistance	$50\Omega$
$f$	Frequency of sine wave	1kHz
$C$	Capacitance of capacitor	?
$X_c$	Reactance of capacitor	$\frac{1}{2\pi fC}$

TABLE I  
INPUT PARAMETERS



$$V_o = \frac{X_c}{\sqrt{R^2 + X_c^2}} \cdot V_i \quad (1)$$

$$\Rightarrow 8V_p = \frac{X_c}{\sqrt{50^2 + X_c^2}} \cdot 10V_p \quad (2)$$

$$\Rightarrow X_c^2 - 1.5625X_c^2 + 2500 = 0 \quad (3)$$

$$\Rightarrow X_c = \frac{200}{3} \quad (4)$$

$$\Rightarrow C = \frac{1}{2\pi \cdot 10^3 \cdot \frac{200}{3}} \quad (5)$$

$$\Rightarrow C = 2.387\mu F \quad (6)$$