

GATE -BM 16

EE23BTECH11057 - Shakunaveti Sai Sri Ram Varun

Question: For the circuit given below, choose the angular frequency ω_0 at which voltage across capacitor has maximum amplitude?

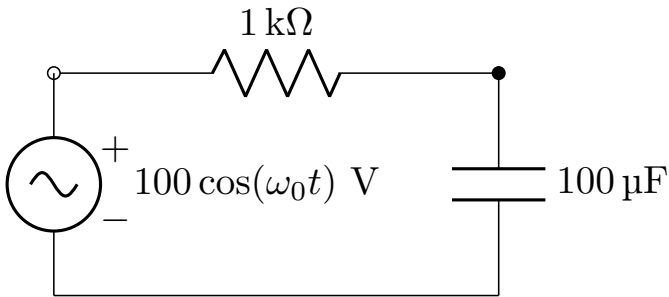


Fig. 1. circuit

- (A) 1000
- (B) 100
- (C) 1
- (D) 0

(GATE BM 2023)

Solution:

$$V_c(s) = \frac{V_1(s) \frac{1}{sC}}{R + \frac{1}{sC}} \quad (1)$$

$$\Rightarrow H(s) = \frac{1}{1 + sRC} \quad (2)$$

$$\therefore H(j\omega) = \frac{1}{1 + j\omega RC} \quad (3)$$

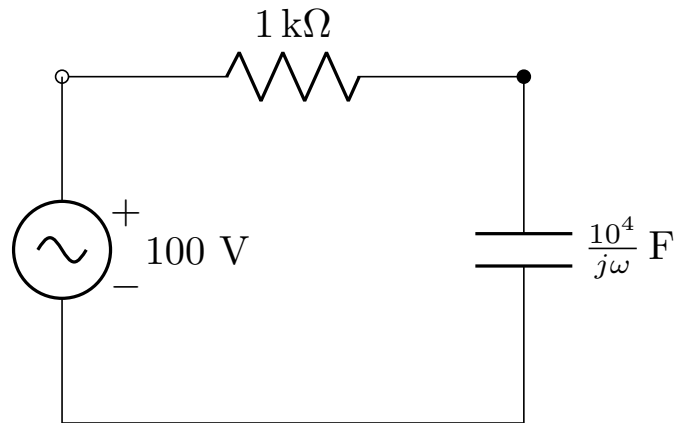


Fig. 2. circuit in ω -domain

$$|v_c(j\omega)| \propto |H(j\omega)| \quad (4)$$

$$|H(j\omega)| = \frac{1}{\sqrt{1 + (\omega RC)^2}} \quad (5)$$

Maximum value of $H(j\omega)$ occurs at $\omega = 0$

$$\therefore \omega_o = 0 \quad (6)$$

| Parameter | Description | Value |
|----------------|---------------------------------------|-------------------------|
| $V_i(j\omega)$ | Input voltage | 100 |
| $v_c(t)$ | Potential difference across Capacitor | ? |
| $V_c(s)$ | Potential difference across Capacitor | $V_c(s)$ |
| $H(s)$ | Transfer function | $\frac{V_c(s)}{V_i(s)}$ |
| V_o | Amplitude of input voltage | 100 V |
| R | Resistance in circuit | 1 k Ω |
| C | Capacitance in circuit | 100 μF |
| ω_o | angular frequency of input voltage | ω_o |

TABLE I

INPUT VALUES