GATE 2022 IN 36

EE23BTECH11065 - prem sagar

Question:
A signal $V_{in}(t)$ shown is applied from t=0ms to t=6ms to the circuit shown Given the intial voltage across capacitor is 0.3V, and that the diode is ideal,the open circuit voltage $V_{out}(t)$ at t=5ms is

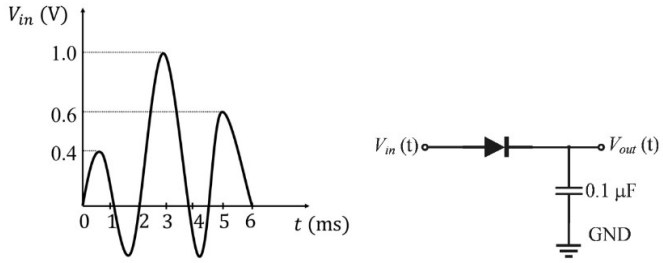

Fig. 1.

Solution:

Symbol	Value	Description
$V_{in}(t)$		input signal
$V_c(t)$		voltage across capacitor
$V_c(0)$	0.3V	intial voltage across capacitor
$v_{out}(t)$		open circuit voltage
V_D		Voltage across diode
I_D		Diode current
I_S		Saturation current
V_T	$\frac{kt}{q}$	Thermal voltage

TABLE 1
INPUT PARAMETERS

the circuit is a positive peak detector circuit

$$I_D = I_S\left(e^{\frac{V_D}{V_T}} - 1\right) \tag{1}$$

At t=3ms; $V_D > 0$
$\therefore$ diode is forward biased

$$\tag{2}$$

$$V_{out}(t) = V_c(t) \tag{3}$$

$$= 1V \tag{4}$$

After t > 3ms; $V_D < 0$
$\therefore$ diode is reverse biased

the capacitor voltage remains at 1V
$\therefore$ at t=5ms

$$V_{out}(t) = 1V \tag{5}$$

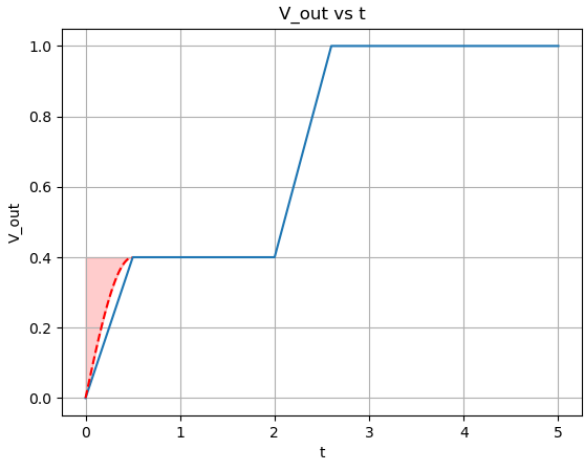

Fig. 1.