

GATE 2022 IN 36

EE23BTECH11065 - prem sagar

Question:

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

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

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

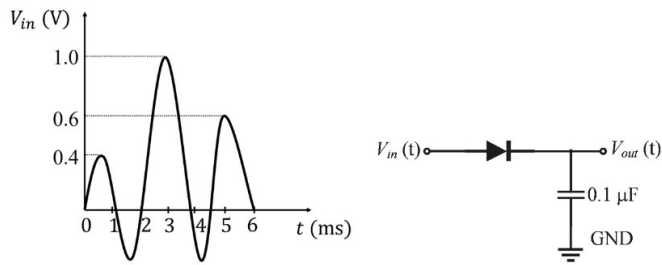
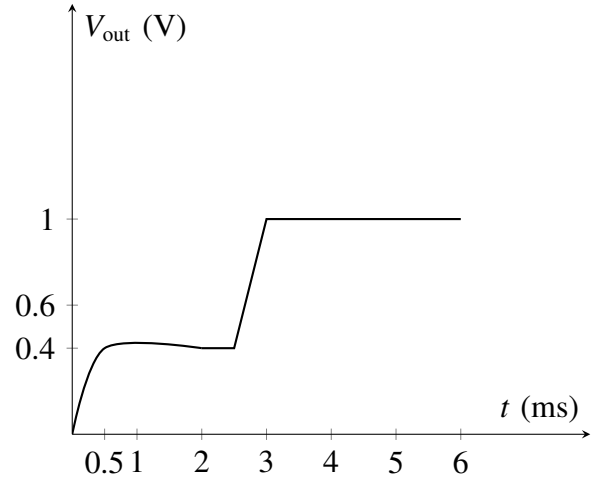


Fig. 1.



Solution:

Symbol	Value	Description
$V_{in}(t)$		input signal
$V_c(t)$		voltage across capacitor
$V_c(0)$	0.3V	initial 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 I

INPUT PARAMETERS

the circuit is a positive peak detector circuit

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

At $t=3\text{ms}$; $V_D > 0$

\therefore diode is forward biased

(2)

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

$$= 1\text{V} \quad (4)$$

After $t > 3\text{ms}$; $V_D < 0$

\therefore diode is reverse biased