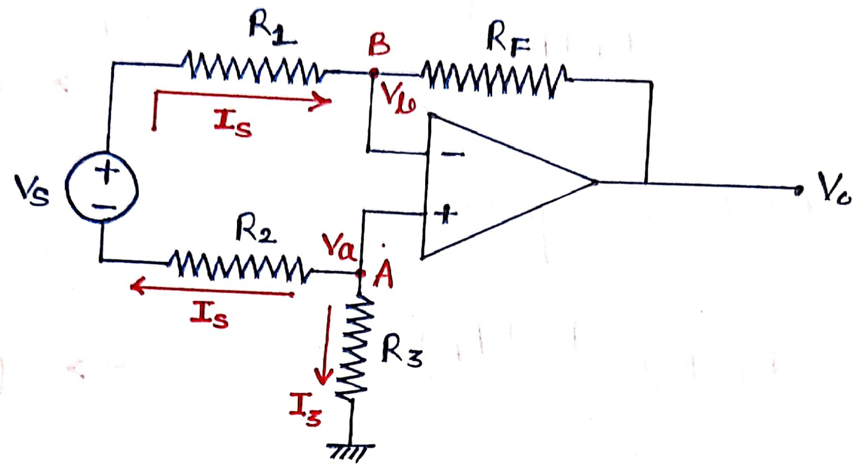
BE QUIZ-2
SOLUTION

SOL(1):



$V_a = V_b$ (Virtual Short) —— (1) → (0.25 Mark)

At node A,

$I_s + I_3 = 0$ (KCL at node A)

$I_3 = -I_s$ —— (2)

$V_a = I_3 R_3 = -I_s R_3$ —— (3) → (0.25 Mark)

At node B,

$I_s = \dfrac{V_b - V_o}{R_F}$ (KCL at node B)

$I_s R_F = V_a - V_o$

$I_s R_F = -I_s R_3 - V_o$

$V_o = -I_s (R_3 + R_F)$ —— (4) → (1 Mark)

Apply KVL between node A & node B, we get –

$$-V_a + I_S R_2 - V_S + I_S R_1 + V_b = 0$$

$$I_S = \left(\frac{V_S}{R_1+R_2}\right) \qquad \text{— (5)}$$

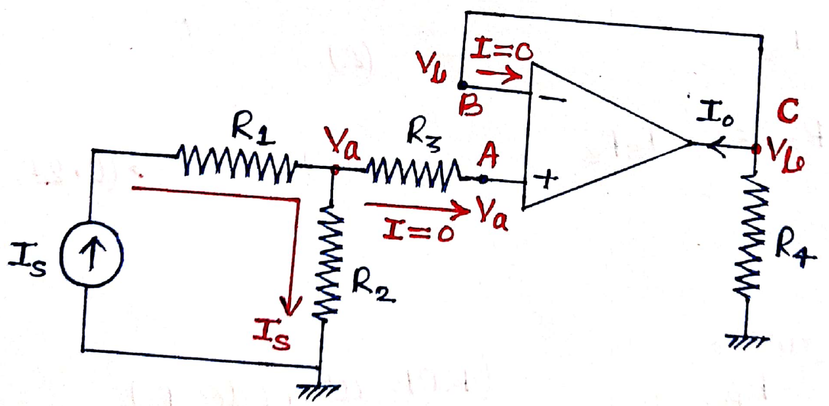
→ (1 Mark)

By eq^n (4) & eq^n (5), we get –

$$V_o = \frac{-V_S}{(R_1+R_2)} (R_3 + R_F)$$

→ (0.50 Mark)

SOL (2):–



$$V_a = I_S R_2 \qquad \text{— (1)}$$

→ (0.5 Mark)

$$V_b = V_a = I_S R_2 \qquad \text{— (2)}$$

(Virtual Short) → (0.5 Mark)

At node-C,

$$I_o = \frac{-V_b}{R_4} \qquad \text{(KCL at node-C)}$$

$$\therefore I_o = -\left(\frac{R_2}{R_4}\right) I_S$$

→ (1 Mark)

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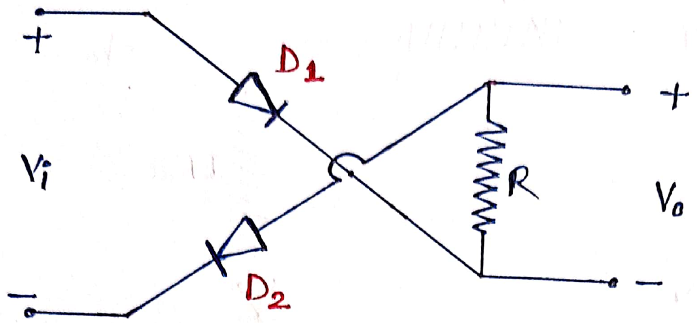
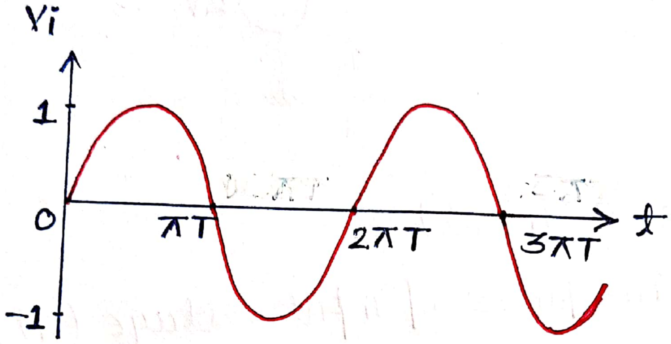
SOL(3):





→ (0.25 Mark)

Case(I):

During positive pulse of input voltage (V_i), both diodes are ON (Forward biased). Hence –

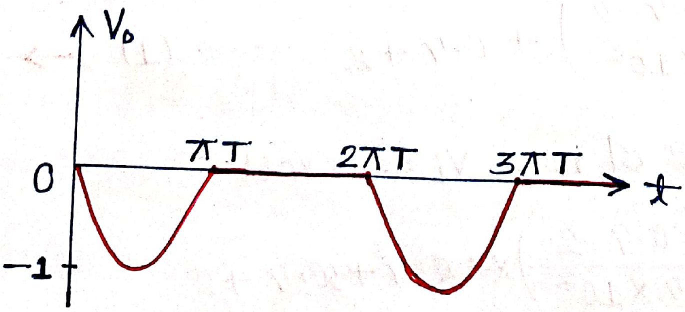
$$V_o = -V_i \qquad — (1)$$

→ (0.5 Mark)

Case (II): During negative pulse of input voltage (V_i), both diodes are OFF (Reverse biased). Hence –

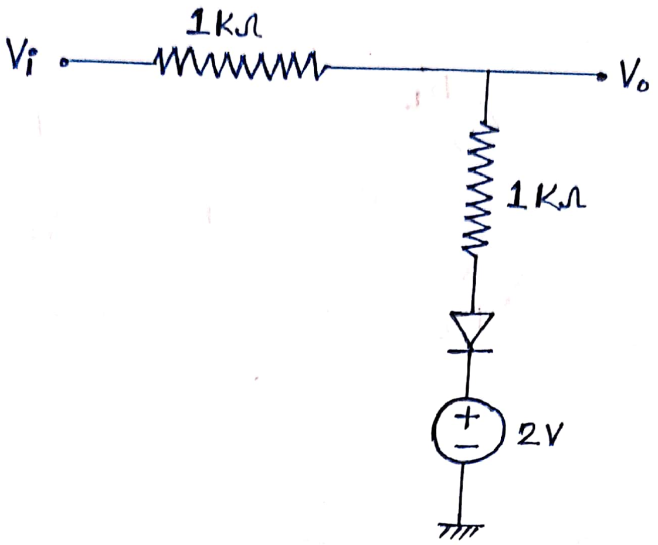
$$V_o = 0 \qquad — (2)$$

→ (0.5 Mark)



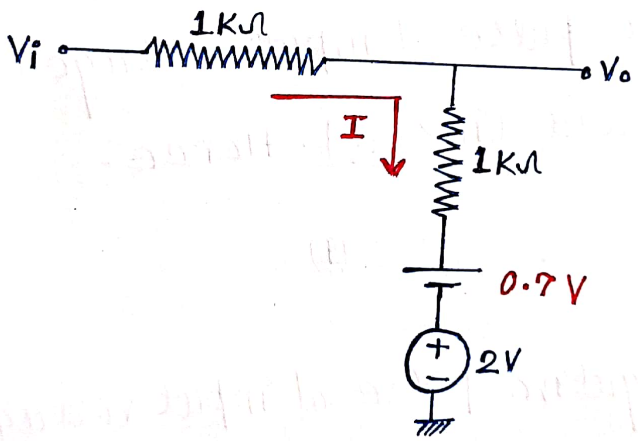
→ (0.75 Mark)

SOL(4):



Given that — $V_i = 5\sin(\omega t)$

Case(I): During positive pulse of input voltage (V_i), diode is ON (forward bias)



Here, $V_o = I \times 1 \times 10^3 + 0.7 + 2$

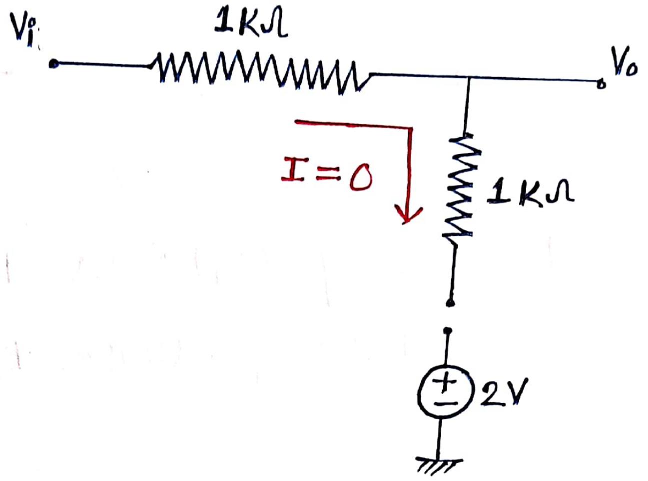
$$V_o = 1 \times 10^3 \times \left(\frac{V_i - 0.7 - 2}{2 \times 10^3}\right) + 0.7 + 2 \quad \text{--- (1)} \rightarrow \text{(0.5 Mark)}$$

For maximum value of V_o, $V_i = 5$ Volt.

$$\therefore V_o = \left(\frac{5 - 0.7 - 2}{2 \times 10^3}\right) \times 1 \times 10^3 + 0.7 + 2$$

$$\therefore (V_o)_{maximum} = 3.85 \text{ Volt} \quad \rightarrow \text{(1 Mark)}$$

Case (II): During negative pulse of input voltage (V_i), diode is OFF (reverse bias).



Here, $V_o = V_i$

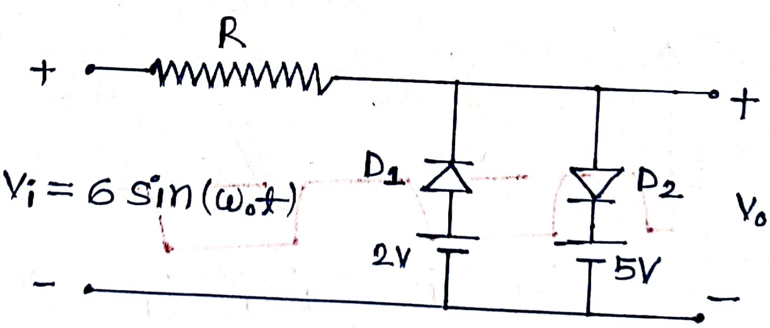
→ (0.5 Mark)

For minimum value of V_o, $V_i = -5$ Volt

$\therefore (V_o)_{minimum} = -5$ Volt → (1 Mark)

SOL(5):

(a)



Case(I): If input voltage (V_i) < 2V then diode D_1 is ON (forward bias) & diode D_2 is OFF (reverse bias).

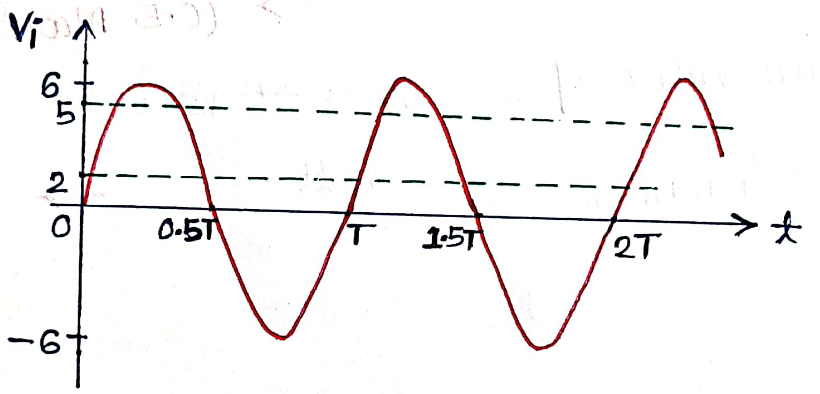
Here, $V_o = 2$ Volt — (1) → (0.75 Mark)

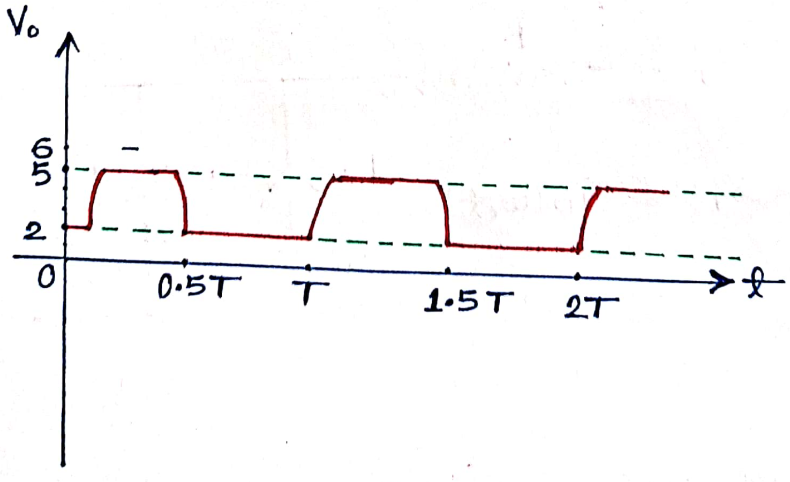
Case (II): If $2V <$ input voltage$(V_i) < 5V$ then both diode D_1 & D_2 is OFF (reverse bias)

Here, $V_o = V_i$ —— (2) → (0.75 Mark)

Case (III): If input voltage $(V_i) > 5V$ then diode D_1 is OFF (reverse bias) & diode D_2 is ON (forward bias).

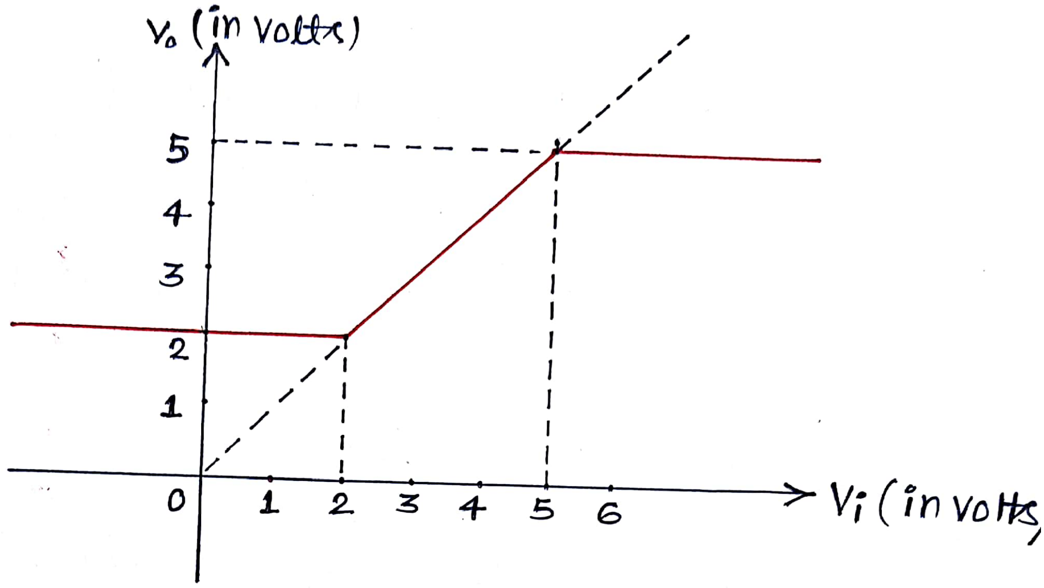
Here, $V_o = 5V$ —— (3) → (0.75 Mark)





→ (0.75 Mark)

SOL(5)(b) : By case(I), case(II) & case(III), we get –



→ (1 Mark)