Set 01

1.(a) Assumptions for the parcameteros of an ideal op-amp -

i) Infinite open loop gain.

ii) Infinite input resistance.

iii) Zero output resistance.

(b) $V_o = \frac{-1}{RC}\int V_i dt$

(c) Because of non-linearc I-V characteristic.

(d)

F.B :- $i_D > 0$

R.B :- $V_D \leqslant V_{DO}$

Set 02

1. (a) Same as 1(a) [Set 01]

(b) $V_o = -RC\frac{d}{dt}V_i$

(c) Same as 1(c) [Set 01]

(d)

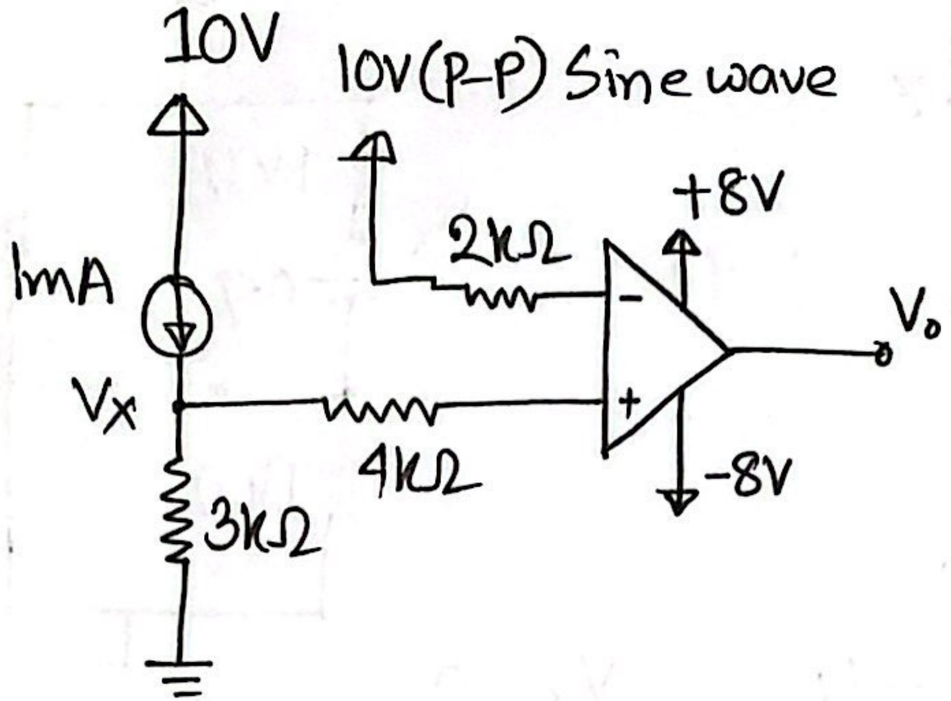
F.B :- $i_D > 0$

R.B :- $V_D \leqslant 0$

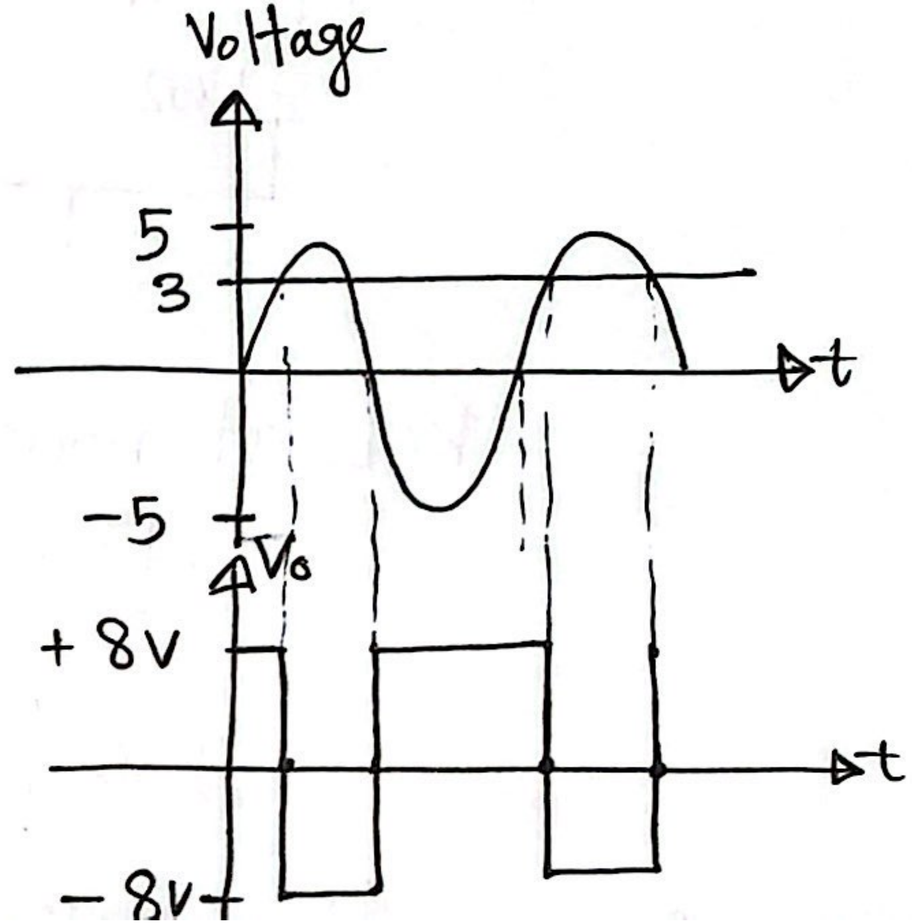
Set-01

Q2

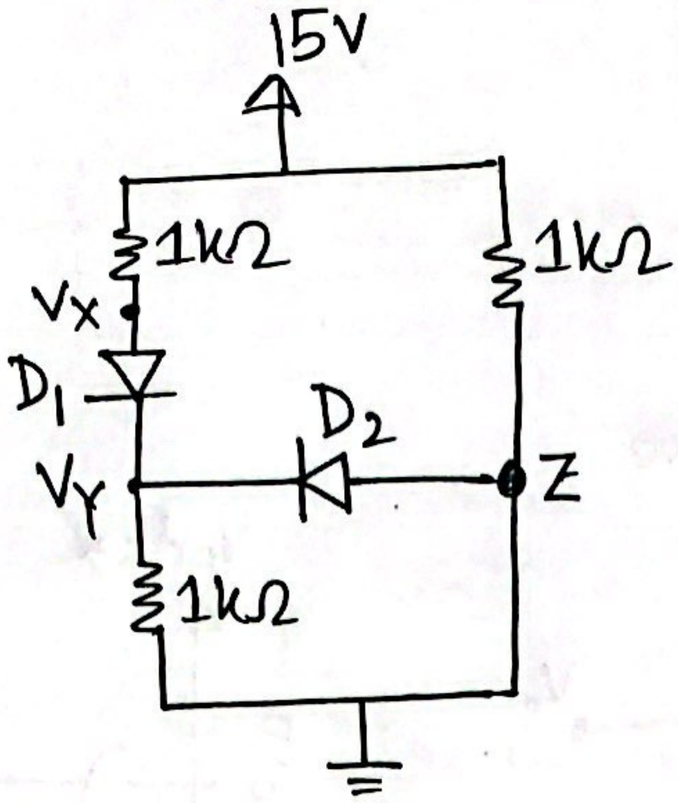
(a)



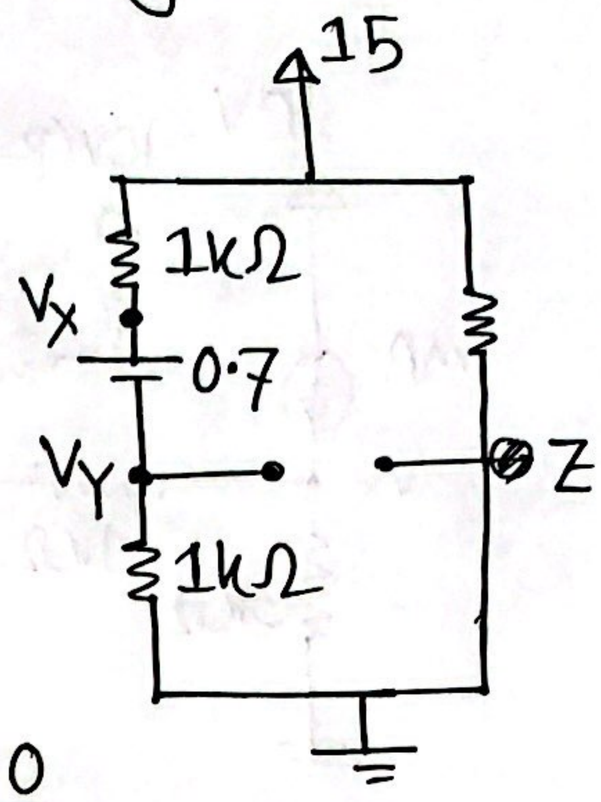
$$V_x = (1 \times 3)\,V = 3V$$



(b)



Assuming D_1 on and D_2 off



KCL at node Y-

$$\frac{15-0.7-V_Y}{1} = \frac{V_Y-0}{1}$$

$$\Rightarrow \boxed{V_Y = 7.15\,V} \qquad \boxed{\therefore V_X = 7.85\,V}$$

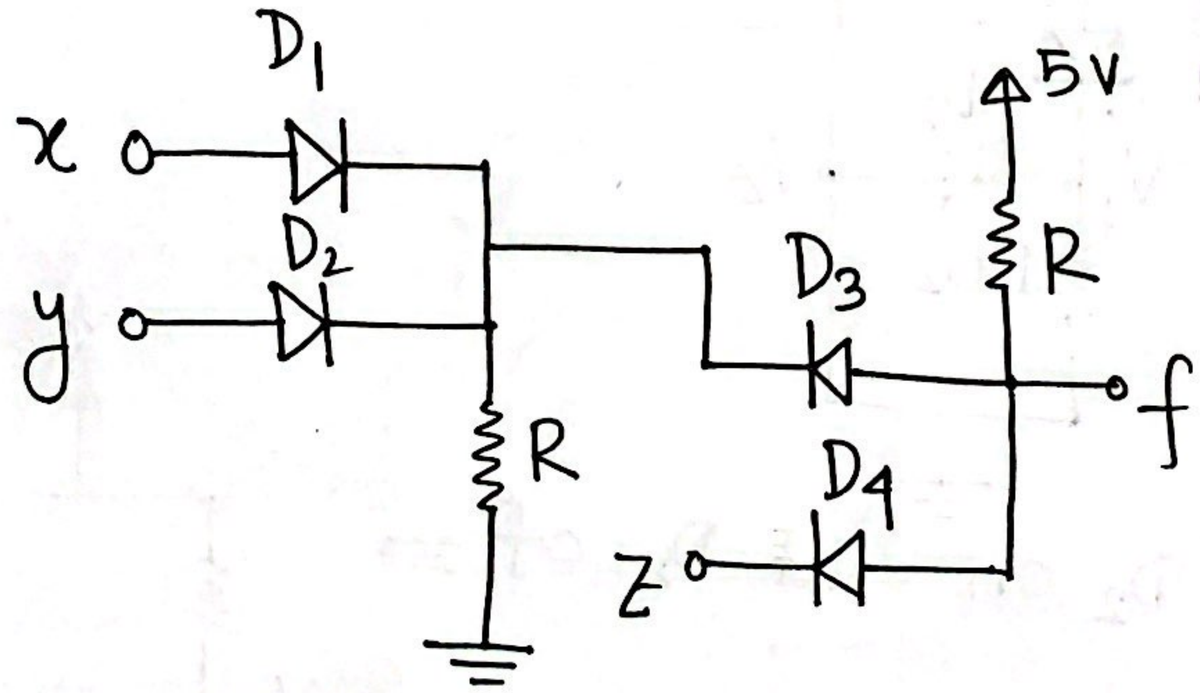
Assumption validation:-

$$\boxed{\begin{aligned} I_{D1} &= 7.15\,mA \\ I_{D2} &= 0\,mA \end{aligned}}$$

$$I_{D1} = \frac{15-7.15-0.7}{1} > 0$$

$$V_{D2} = V_Z - V_Y = 0 - 7.15 < V_{D02}$$

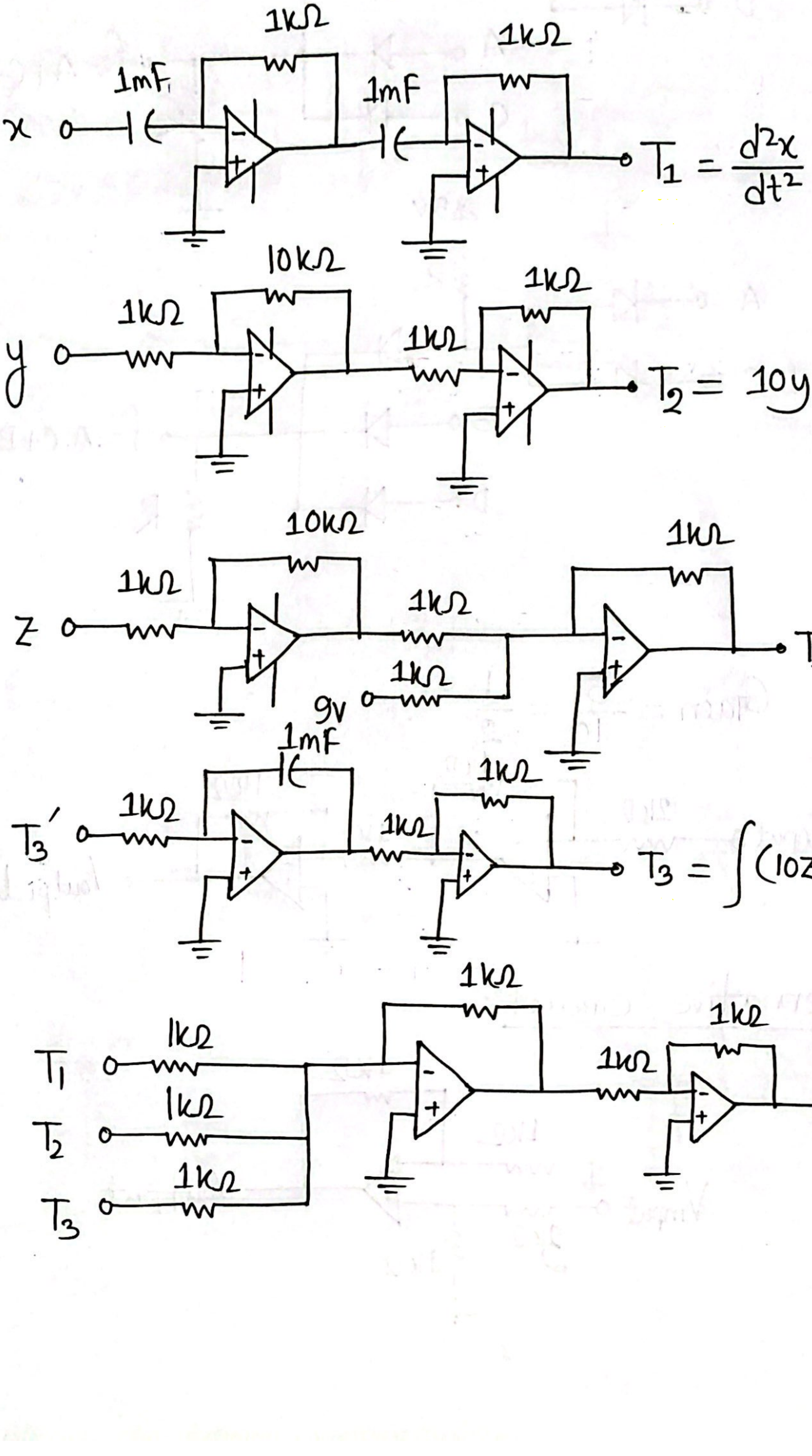
(c)



$$\boxed{f = (x|y).z} \quad \text{or} \quad \boxed{f = (x+y).z}$$

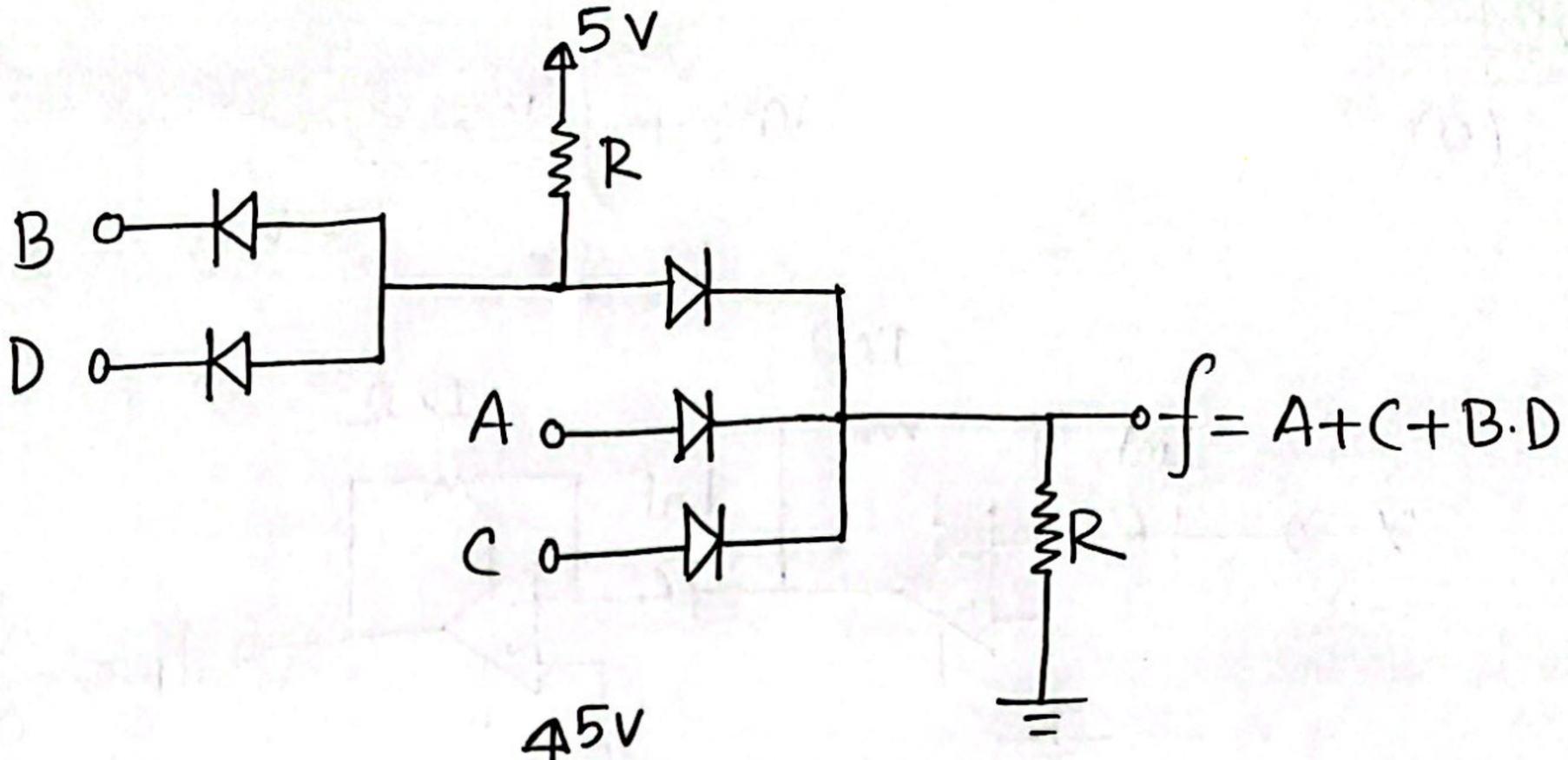
Q3

(a) $f = \frac{d^2x}{dt^2} + 10y + \int \underbrace{(10z-9)}_{T_3'} dt$

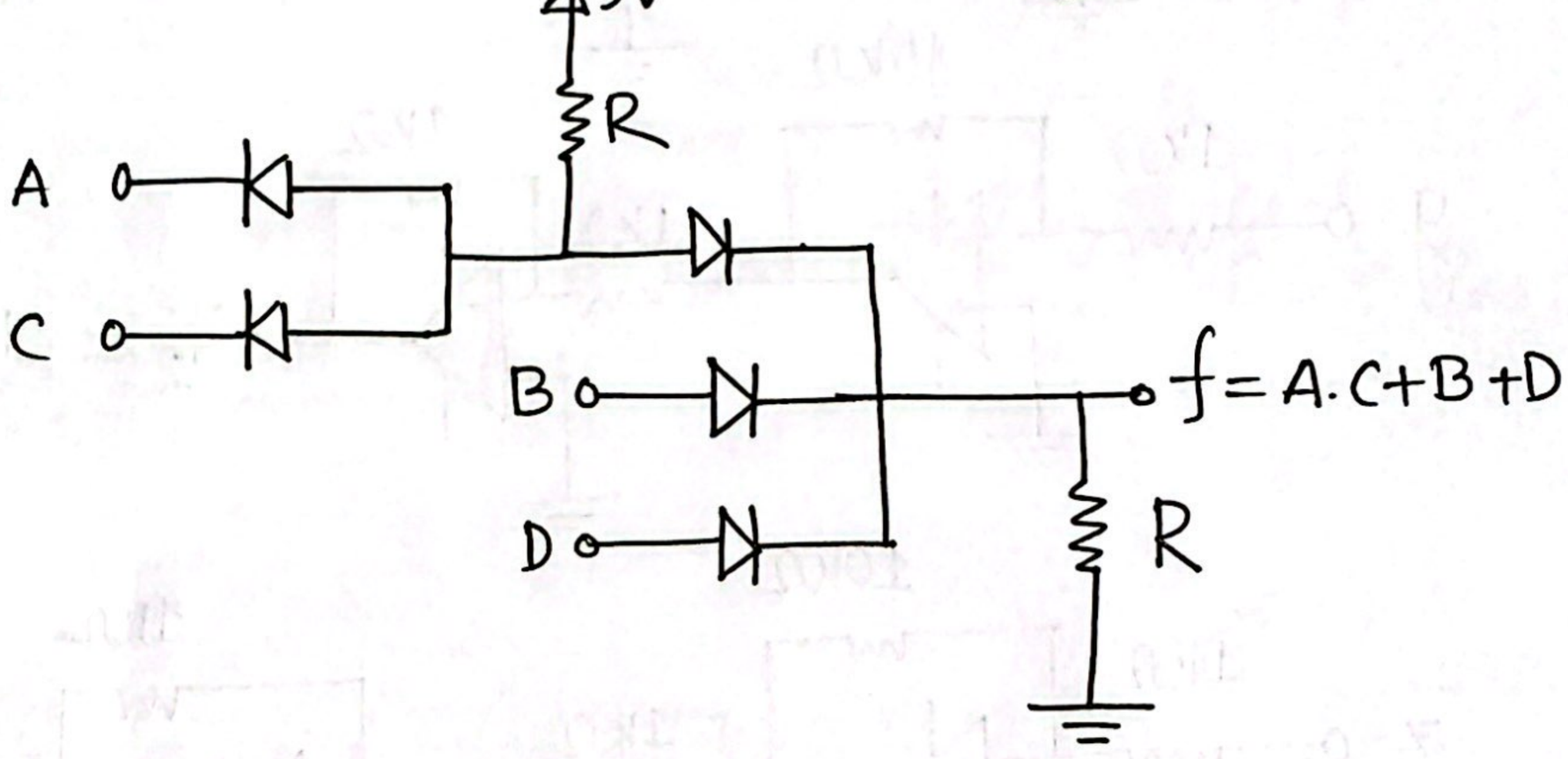


(b)

1.

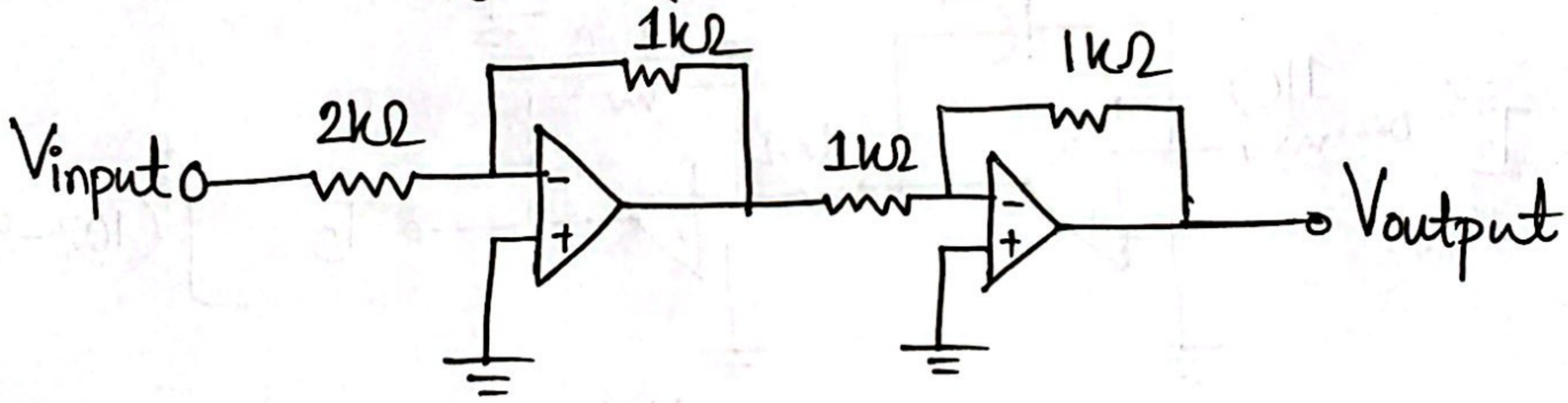


2.

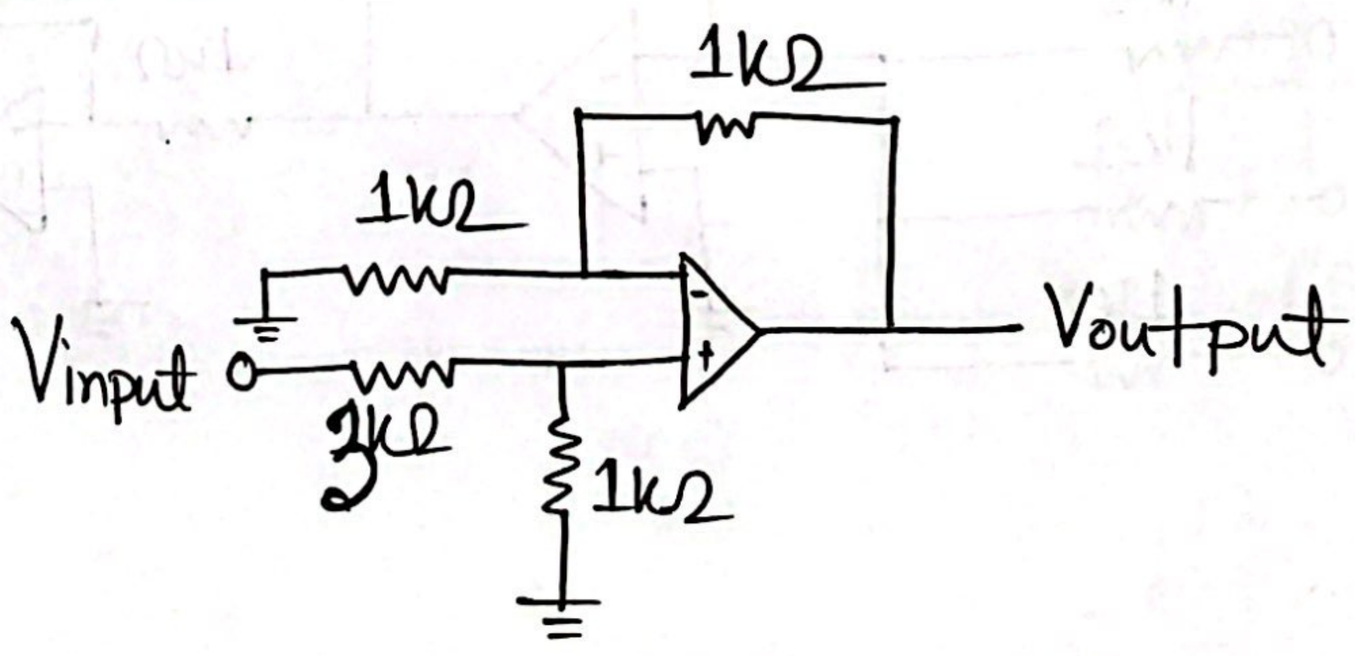


(c)

$$\text{Gain} = \frac{5}{10} = \frac{1}{2}$$



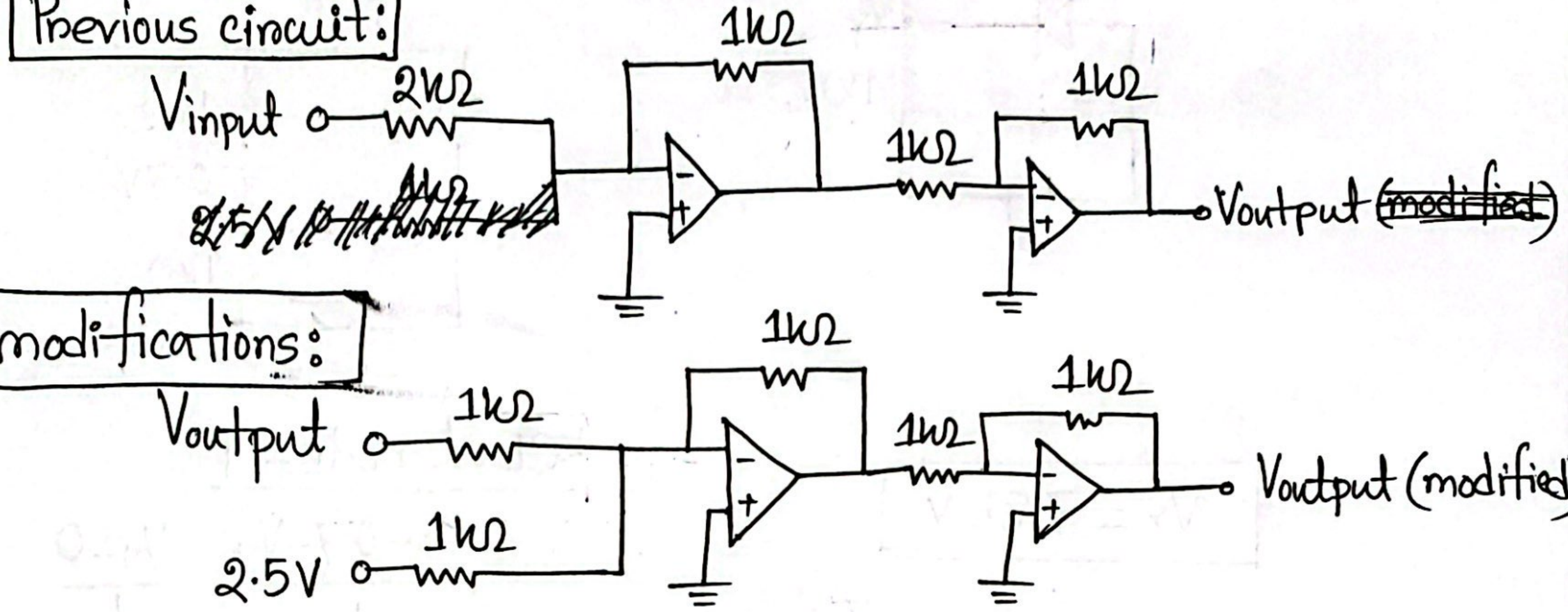
Alternative circuit:-



(d) $V_{output(modified)} = 2.5 + V_{output}$

A possible modification-

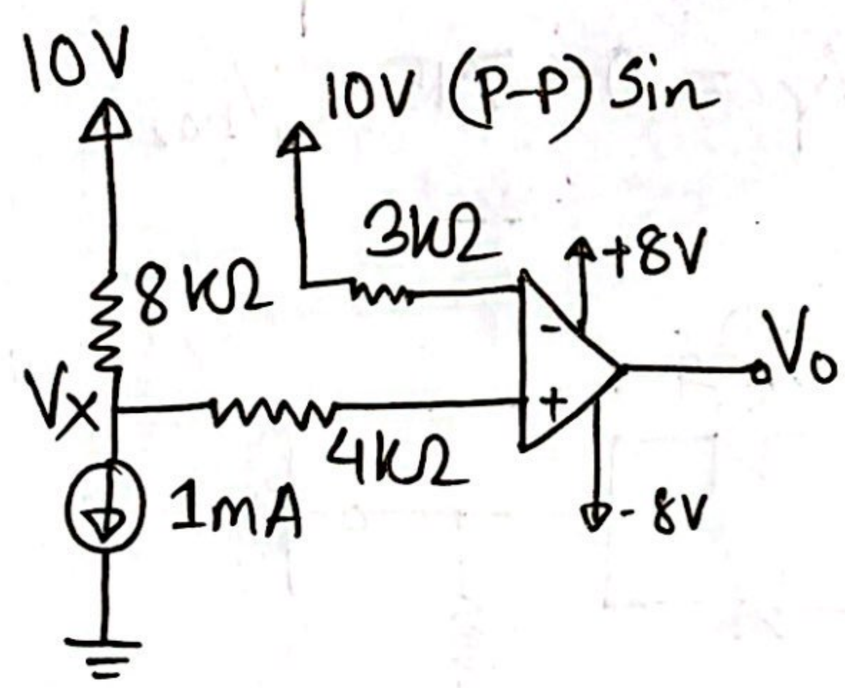
Previous circuit:



modifications:

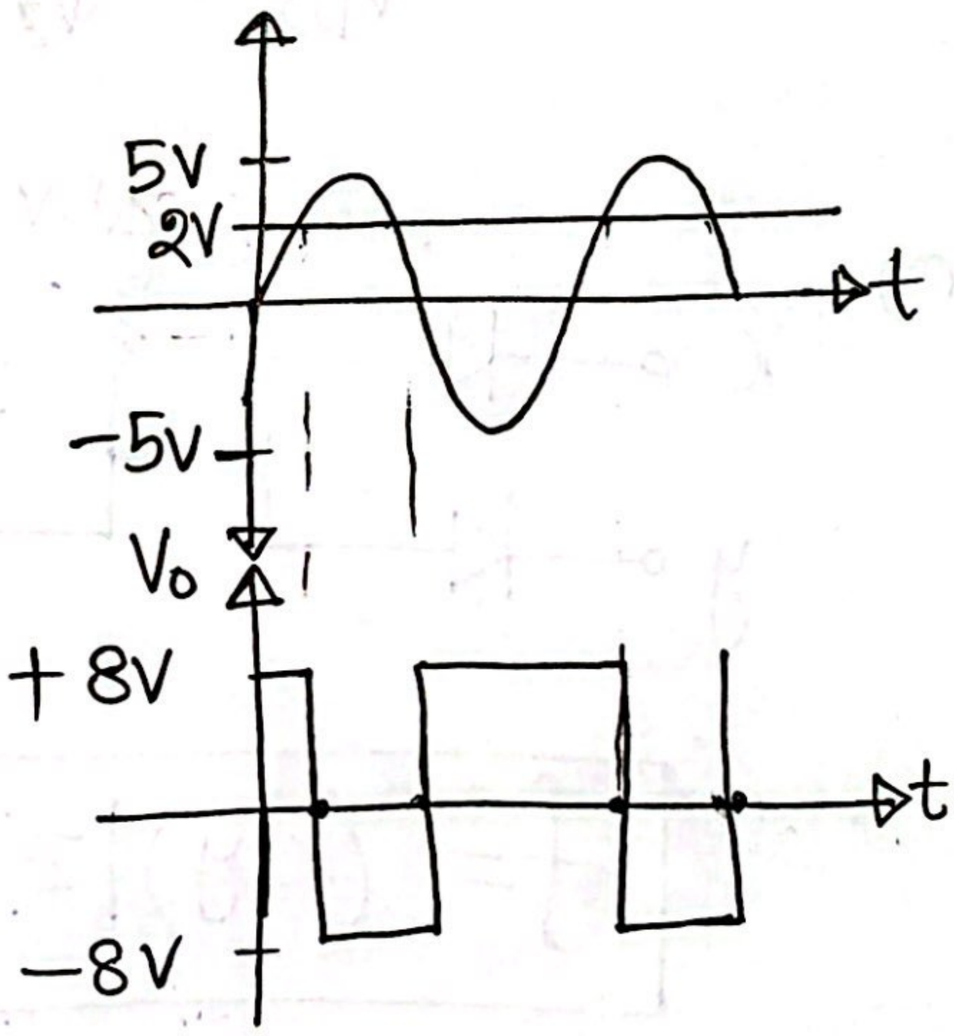
Set 02

2. (a)

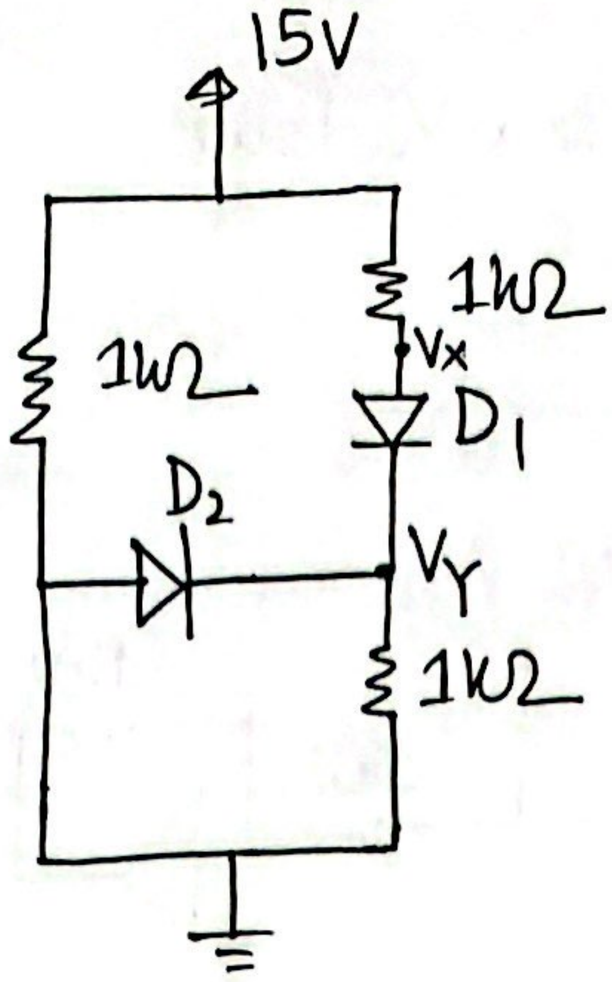


$$\frac{10 - V_x}{8} = 1$$

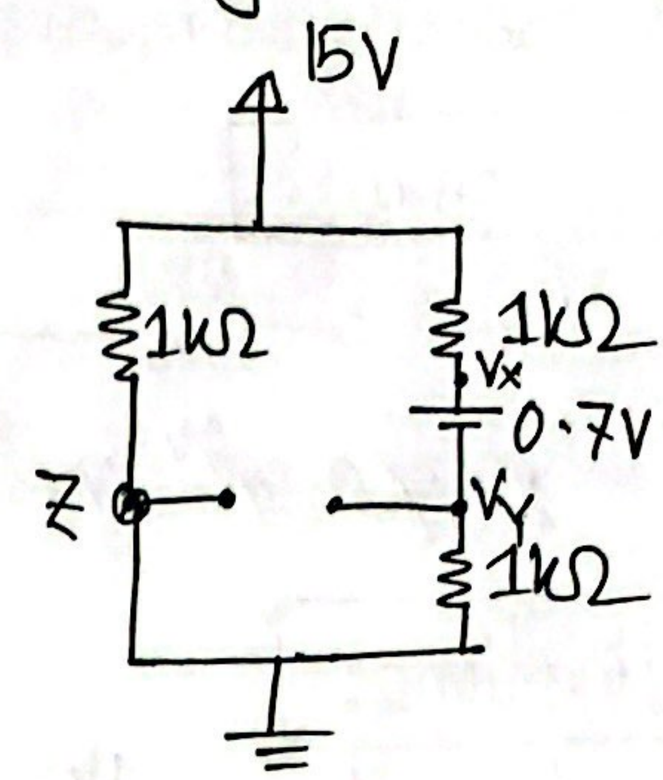
$$\Rightarrow \boxed{V_x = 2V}$$



(b)



Assuming D_1 on ~~a~~ and D_2 off



KCL at node-Y

$$\frac{15-0.7-V_y}{1} = \frac{V_y-0}{1}$$

$$\Rightarrow \boxed{V_y = 7.15\ V}$$

$$\therefore V_x = 7.85\ V$$

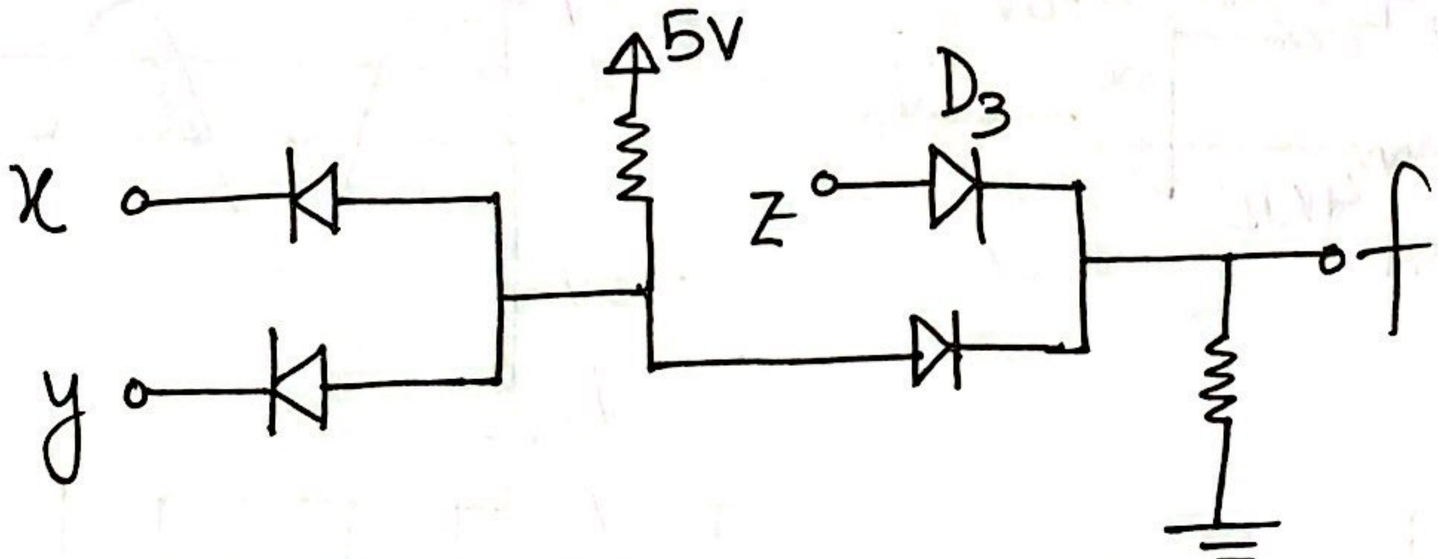
Assumption Validation:-

$$I_{D1} = \frac{15-7.15-0.7}{1} > 0$$

$$V_{D2} = V_Z - V_Y = 0 - 7.15 < V_{D02}$$

$$I_{D1} = 7.15\text{mA}$$
$$I_{D2} = 0\text{ mA}$$

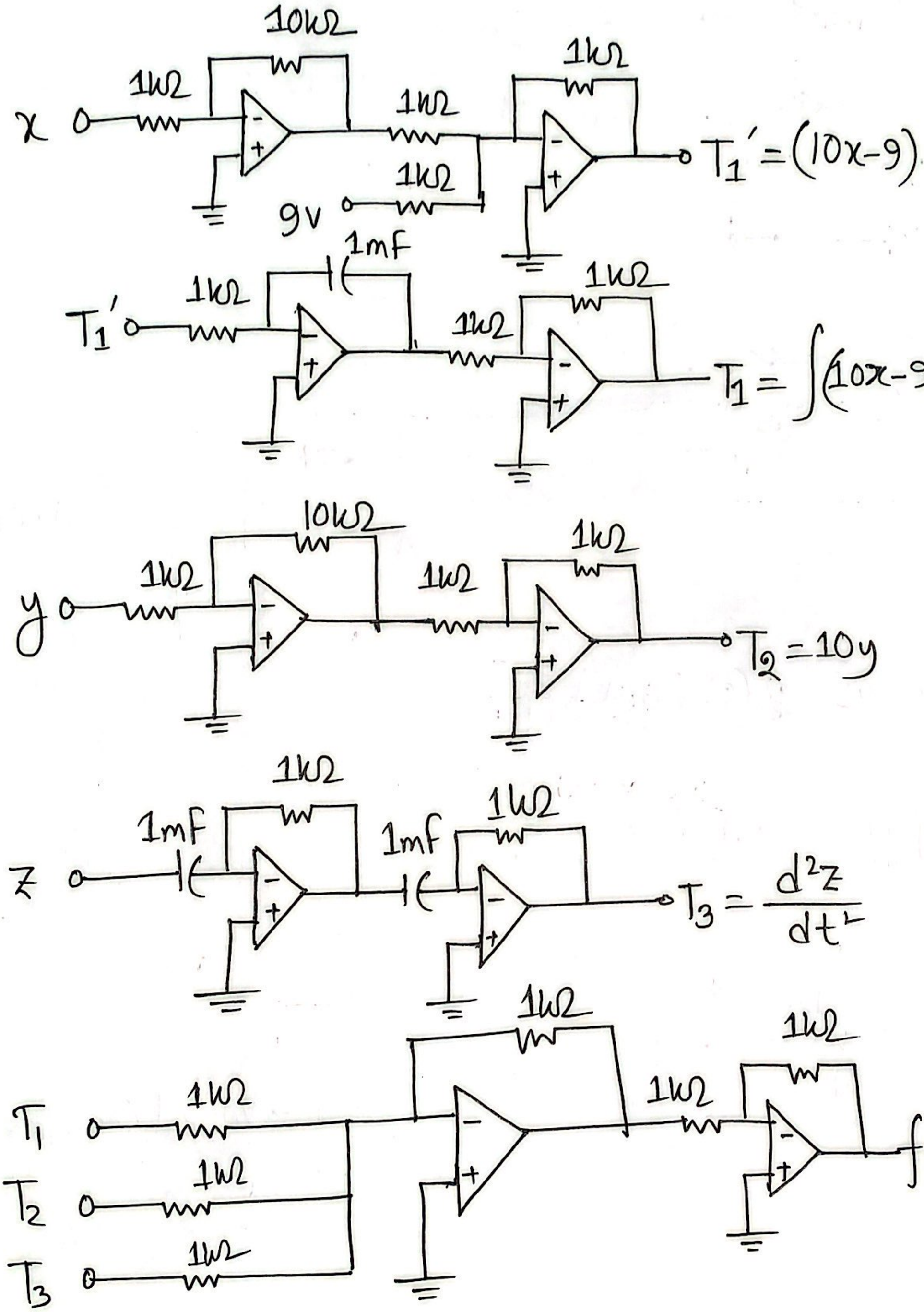
(c)



$$\boxed{f = (x \cdot y)\,|\,z} \quad \text{or} \quad \boxed{f = (x \cdot y) + z}$$

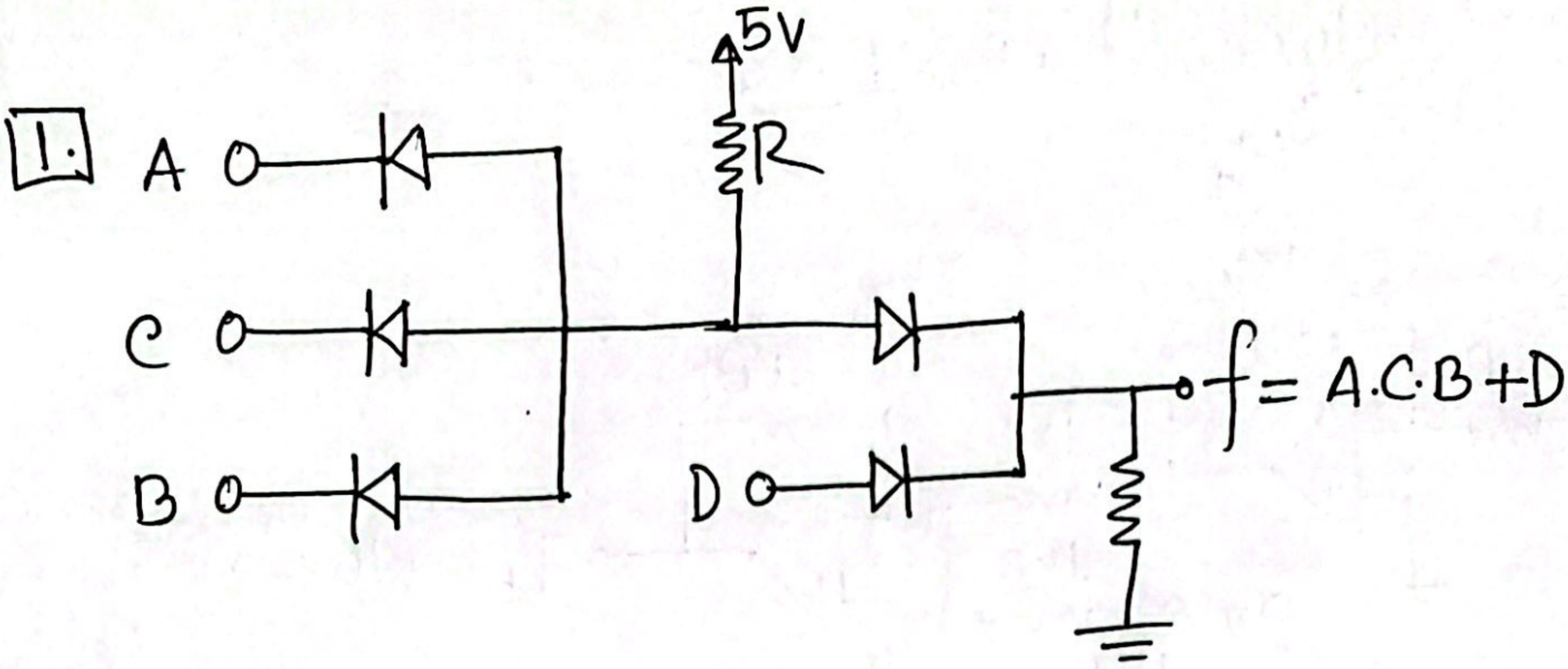
Q3

(a) $f = \int \underbrace{(10x-9)}_{T_1'} dt + 10y + \frac{d^2z}{dt^2}$

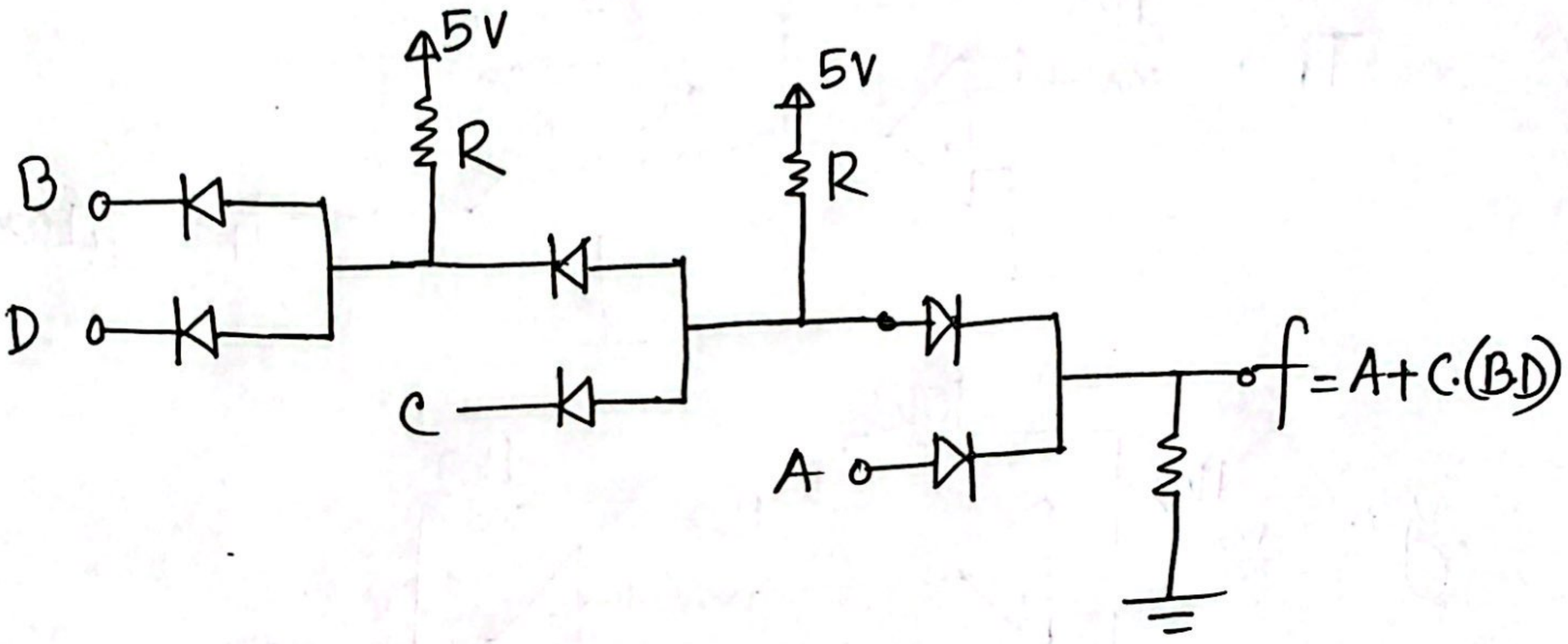


c)

1.



2.



(c) Same as 3(c) [Set 01]

(d) $V_{output\ (mod)} = -2.5 + V_{output}$.

modifications:-