Assignment # 2

CSE251

Fall 22

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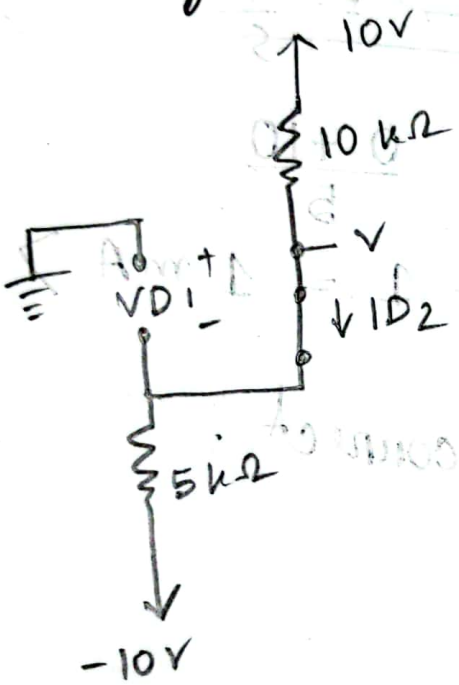
sec : 13

ID : 21301610

Ans to Q 1

(i)

Assuming D_1 as OFF and D_2 as ON :



Here, $I_{D_2} = \frac{10-(-10)}{10+5}$ mA

$= 1.33$ mA which is greater than zero.

$\therefore$ Assump is correct.

Again,

Nodal at V,

$$\frac{V-10}{10} + \frac{V+10}{5} = 0$$

$$\Rightarrow V - 10 + 2V + 20 = 0$$

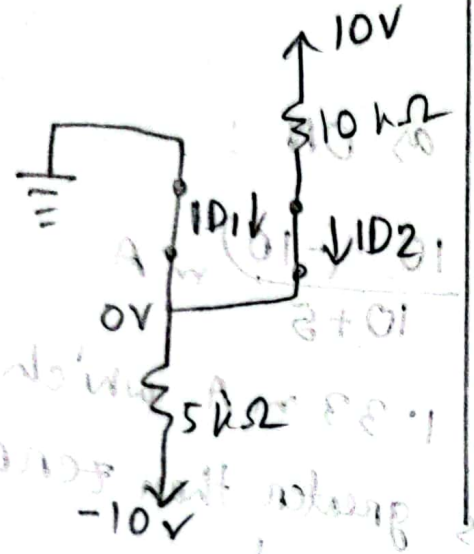
$$\Rightarrow V = -\frac{10}{3}$$

$$\therefore V_{D_1} = 0 - \left(-\frac{10}{3}\right)$$

$$= \frac{10}{3} \neq 0$$

$\therefore$ This assumption is wrong.

Assuming Both D_1 and D_2 are ON:



Here, $I_{D_2} = \frac{10-0}{10} = 1mA > 0$

~~$I_{D_1} = \frac{0-(-10)}{5} = \frac{10}{5}$~~

KCL:

$I_{D_1} + I_{D_2} = \frac{0+10}{5}$

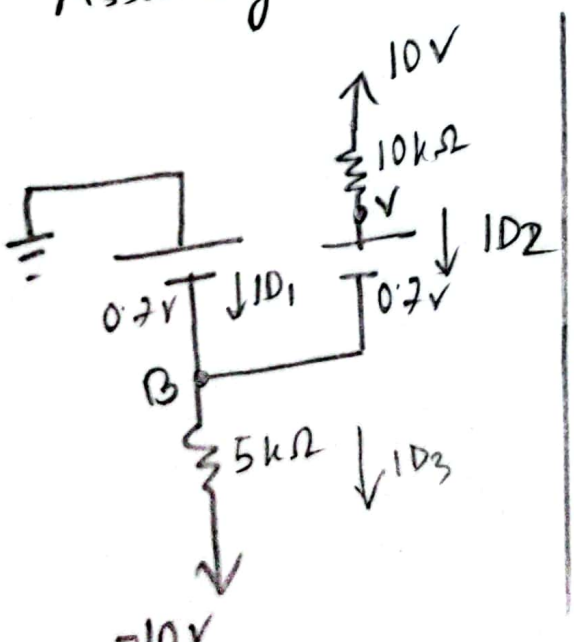
$\Rightarrow I_{D_1} = 2 - 1 = 1\,mA > 0$

$\therefore$ Our both assumtions are correct.

(ii)

Given, $V_{DO} = 0.7V$

Assuming both D_1 and D_2 are ON.



① At D_2: $0.7 = V - B$

② At D_1: $0.7 = 0 - B$

$\Rightarrow B = -0.7$

~~Supernode KCL:~~

~~$\frac{V-10}{10}$~~ Now,

From ① $V = 0.7 + B$

$\Rightarrow V = 0$

Now, $ID_2 = \frac{10-0}{10} = 1\ mA > 0$

KCL:

$ID_1 + ID_2 = \frac{0+10}{5} ID_3$

$\Rightarrow ID_1 = ID_3 - ID_2$

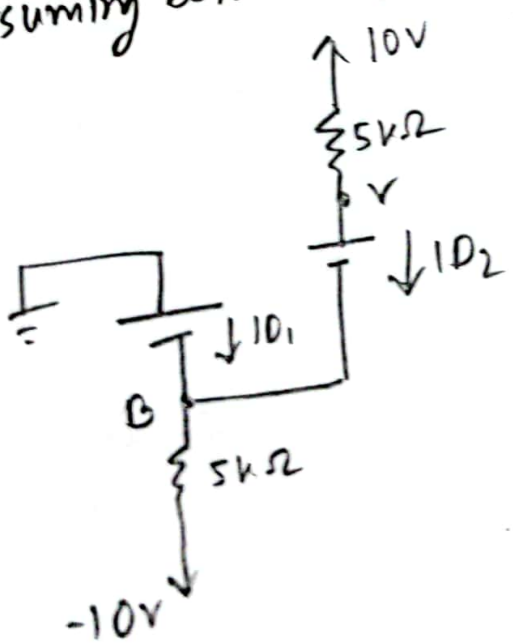
$= \frac{-0.7+10}{5} - 1$

$= 1.86 - 1 = 0.86\ mA > 0$

∴ Both assumptions are correct.

(iii)

Assuming both ON:



At D1,

$0.7 = 0 - B$

$\therefore B = -0.7$

At D2,

$0.7 = V - B$

$\therefore V = 0$

Now, $ID2 = \frac{10}{5} = 2\ mA > 0$

Again,

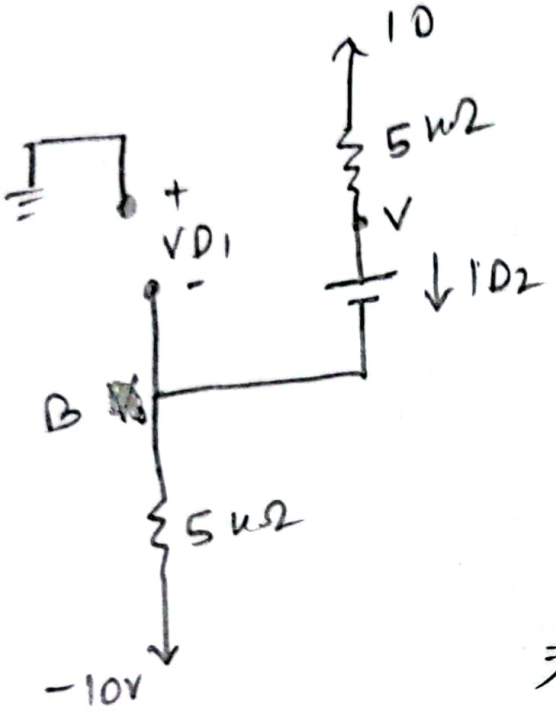
$ID_1 + ID_2 = ID_3$

$\Rightarrow ID_1 = \frac{-0.7+10}{5} - 2$

$= -0.14 \not> 0$

∴ This assumption is wrong.

Assuming D_1 OFF and D_2 ON:



Here,

$0.7 = V - B$

$B = V - 0.7$

At V,

$$\frac{V-10}{5} + \frac{B+10}{5} = 0$$

$$\Rightarrow V - 10 + V - 0.7 + 10 = 0$$

$$\Rightarrow V = 0.35\ V$$

$$B = -0.35\ V$$

Now, $I_{D_2} = \frac{10 - 0.35}{5} = 1.93\ mA > 0$

$V_{D_1} = 0 - B = 0 - (-0.35) = 0.35\ V < 0.7$

∴ Both assumptions are correct.

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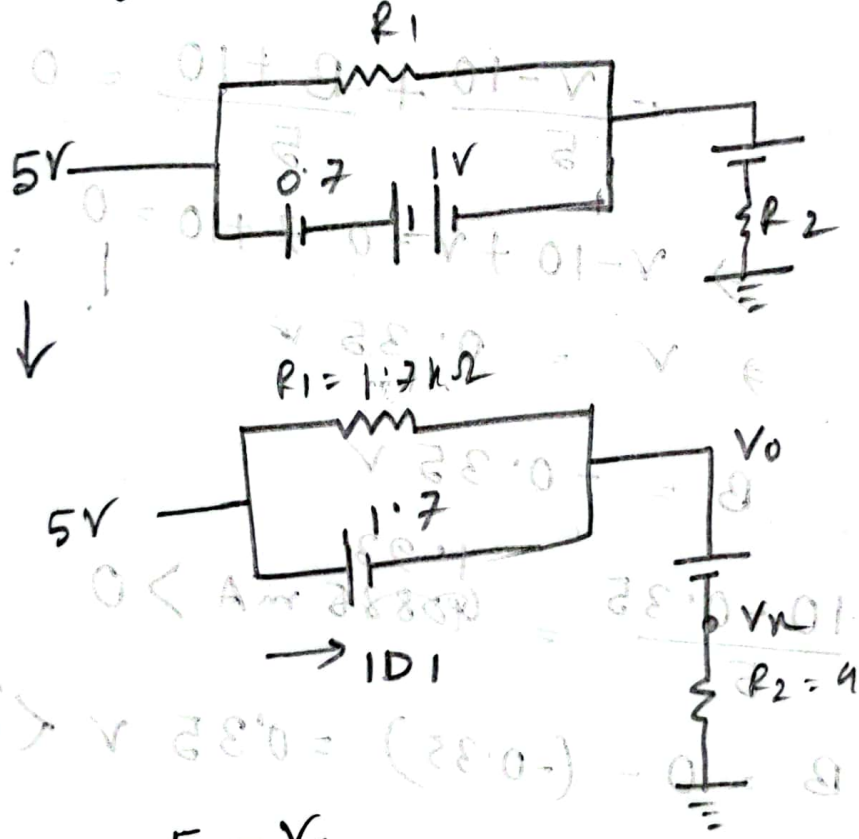
Ans to Q 2

(a)

$V_1 = (5 + 0 \times 10^{-2}) = 5\ V$

Assuming D_1, D_2 are ON!



① $1.7 = 5 - V_o$

$V_o = 5 - 1.7 = 3.3\ V$

② $I_{R_1} = \frac{5 - 3.3}{1.7} = 1\ mA$

③ $0.7 = V_o - V_x$

$\therefore V_x = 3.3 - 0.7 = 2.6\ V$

④ $I_{D2} = \frac{2.6 - 0}{4} = 0.65\ mA > 0$

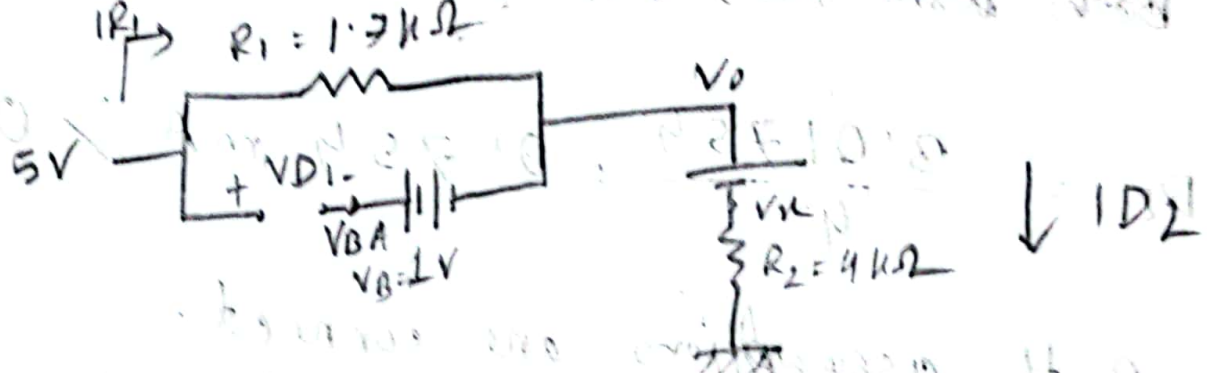
[correct assumption]

⑤ KCL : $I_{D1} + I_{R1} = I_{D2}$

$\Rightarrow I_{D1} = 0.65 - 1 = -0.35\,mA \not> 0$

$\therefore$ This assumption is wrong.

Second Assumption : Assuming D_1 OFF, D_2 ON :



① $1 = V_{BA} - V_o$

② $0.7 = V_o - V_x$

③ $V_{D1} = 5 - V_{BA}$

④ KCL : $I_{R1} = I_{D2}$

$\Rightarrow \frac{5 - V_o}{1.7} = \frac{V_x - 0}{4}$

$\Rightarrow 20 - 4V_o = 1.7 V_x$

$\Rightarrow 20 - 4V_o = 1.7 (V_o - 0.7)$ [From eqn 2]

$\Rightarrow -5.7 V_o = -21.19$

$\Rightarrow V_o = 3.7175\,V$

$\therefore V_x = 3.01754\,V$

~~$\therefore V_x = 3.01887$~~

$\therefore I_{R1} = \frac{5 - 3.7175}{1.7} = 0.754\,mA$

from eqr 1,

$$V_{BA} = 1 + V_o = 1 + 3.717 = 4.7175\ V$$

From 3,

$$V_{D1} = 5 - 4.7175 = 0.2825 < 0.7$$

∴ ~~Both assu~~ This assumption is correct.

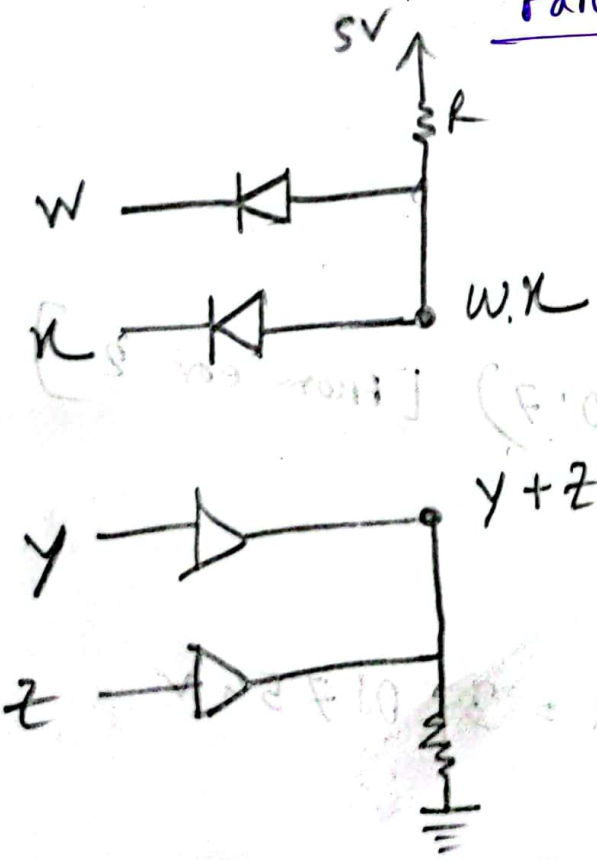
$$I_{D2} = \frac{3.01754}{4} = 0.754\ mA > 0$$

∴ Both assumptions are correct.

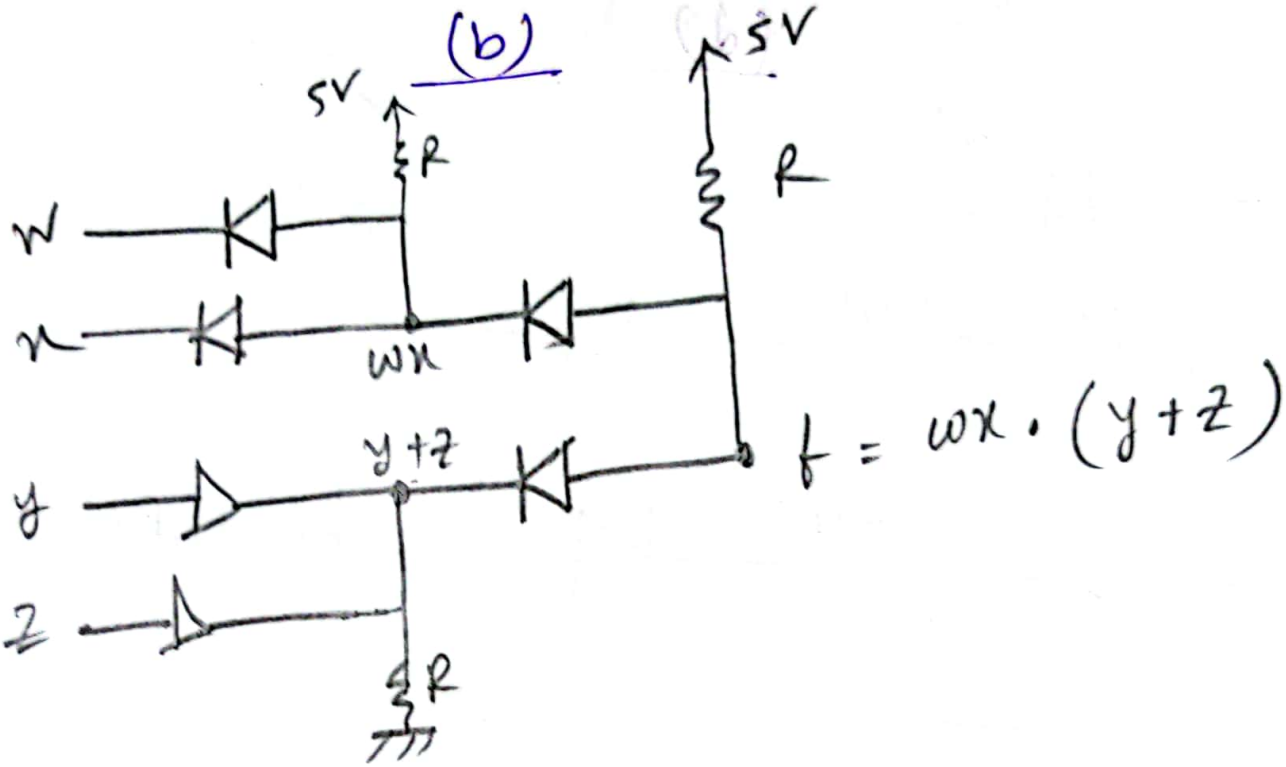
Ans to Q 3

Part a

(ii)



(b)



Part b

(c) Boolean signals F, R, G, N

Condition: ① → F
② → R
③ → G
④ → N

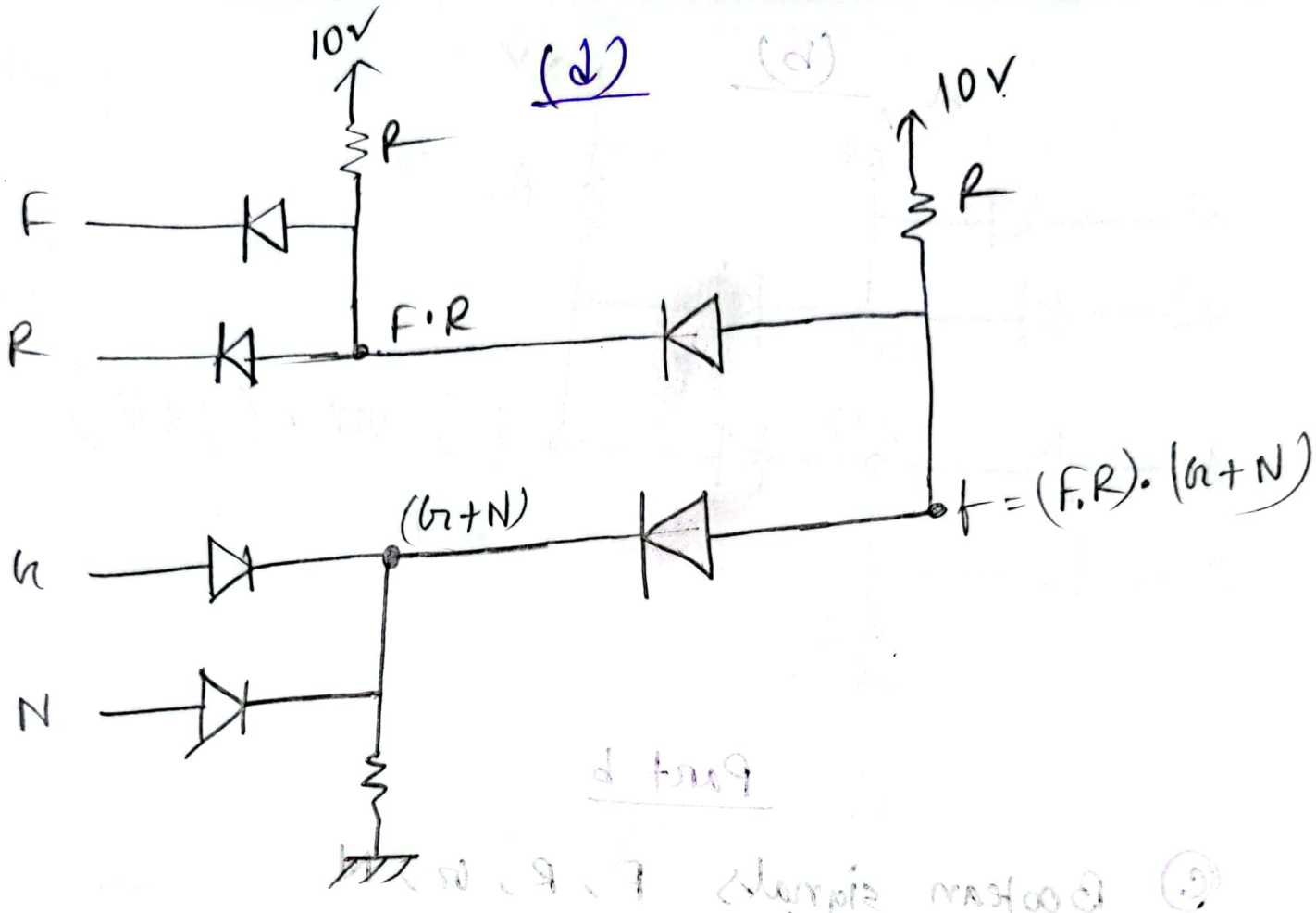
∴ So we take the MIN / AND operation. So if any is not satisfied it won't work. (F · R)

Both 1, 2 has to be satisfied.

Again, Either 3 or 4 has to be satisfied

So we take (G+N)

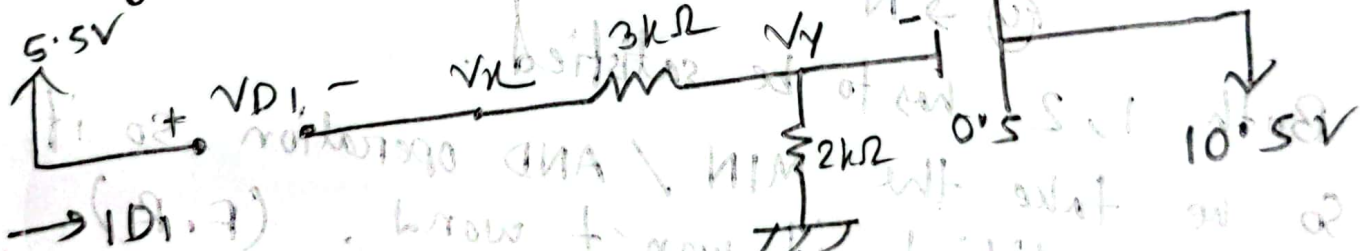
∴ Final output = (F · R) · (G+N)



Ans to Q 4

$V_{D0} = 0.5\ V$

Assuming D_1 OFF and D_2 ON :



① $0.5 = 10.5 - V_y$

$\therefore V_y = 10$

② $I_{D2} = \frac{10}{2} = 5 > 0$

[Correct assumption]

③ $I_{D_1} = 0$ [short circuit]

④ $\frac{V_x - V_y}{3} = 0$

$\Rightarrow V_x = V_y = 10$

⑤ $V_{D_1} = 5 \cdot 5 - 10 = -4 \cdot 5\,V < 0 \cdot 7$

∴ Both assumptions correct.