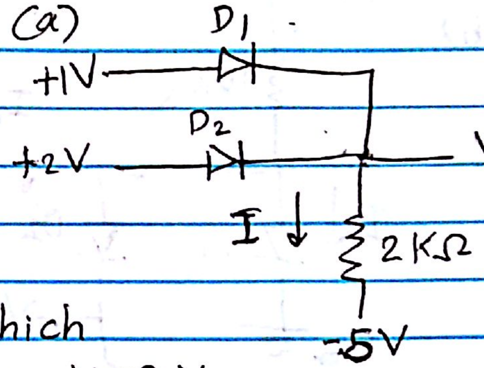
ECE 255 HW 3

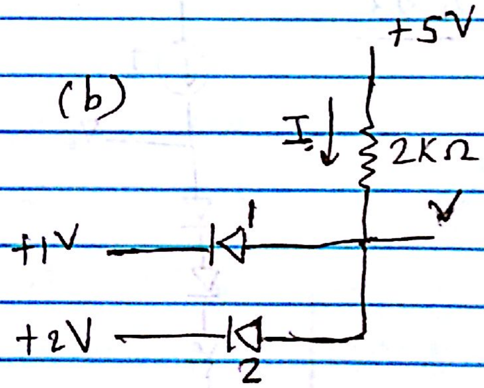
4.3



D_2 is Forward biased. so $V = 2V$ and that makes D_1 Reverse biased.

If D_1 is FB, then $V = 1V$, which makes D_2 FB as well making $V = 2V$ which creates ambiguity. so this assumption does not work.

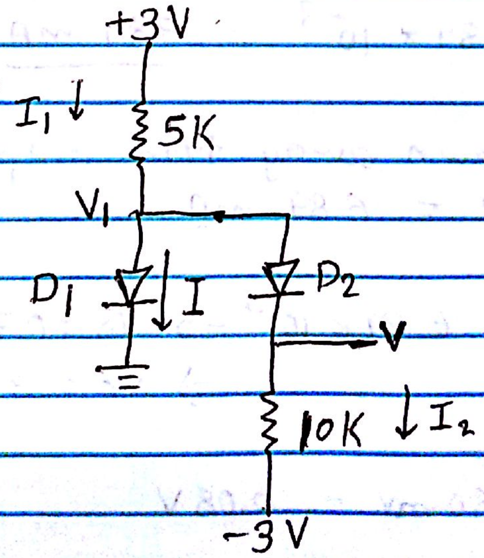
$V = 2V$ $\quad I = \frac{2-(-5)}{2K} = \frac{7}{2K} = 3.5\ mA$



$V = 1V$ $\quad I = \frac{5-1}{2K}$

$= \frac{4}{2K} = 2\ mA$

4.9 (a)



If D_1 is FB, $V_1 = 0V$.
if D_2 is FB, $V = V_1 = 0V$

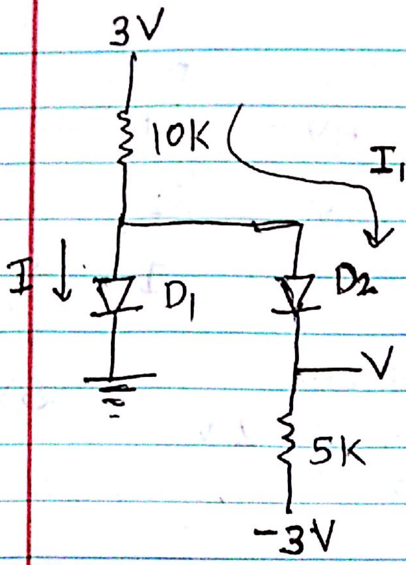
$I_2 = \frac{(3)}{10K} = 0.3\ mA$

$I_1 = \frac{3}{5K} = 0.6\ mA$

hence $I = 0.3\ mA$ (KCL)

Scanned by CamScanner

(b)



D_1 and D_2 can't be FB as before ~~since~~,

D_1 will be RB, D_2 will be FB

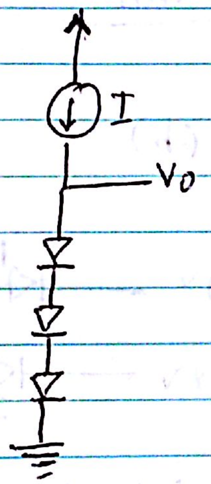
$I = 0$ $\qquad I_1 = \frac{3-(-3)}{(10+5)K}$

$= \frac{6}{15K} = 0.4$ mA

$\frac{V-(-3)}{5K} = 0.4$

$V + 3 = 2 \Rightarrow V = -1V$

4.23



3 identical diodes. so $V_D = \frac{V_O}{3} = \frac{2.4}{3}$

$= 0.8V$

$I_D = I_S(e^{V_D/V_T} - 1) = I$ (−1 can be neglected)

$I = 10^{-16}(e^{0.8/0.025})$

$= 7.89 \times 10^{-3} = 7.89$ mA

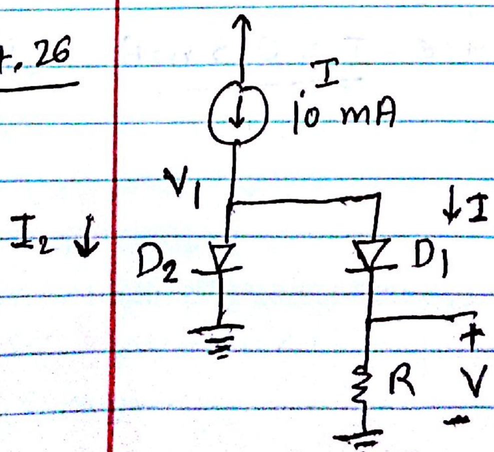
1 mA is drawn away from output terminal,

$I = 7.89 - 1 = 6.89$ mA

$I = I_S(e^{V_D/0.025}) = 6.89 \times 10^{-3} \Rightarrow V_D = 0.796$ V

$\Rightarrow V_O = 3V_D = 2.39$ V

4.26



$V = 80$ mV $= 0.08$ V

For D_2, $I_2 = I_S e^{V_1/V_T}$

For, D_1

$I_1 = I_S e^{(V_1 - 0.08)/V_T}$

Identical diodes, so same I_S for D_1 & D_2

$$\frac{I_1}{I_2} = e^{(-0.08/V_T)} = 0.04$$

and $I_1 + I_2 = 0.01$

$I_2(0.04) + I_2 = 0.01$

$I_2(1.04) = 0.01$

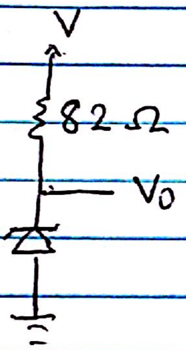
$\Rightarrow I_2 = 0.0096$ A

$= 9.6$ mA

$I_1 = 0.4$ mA

$$V = I_1 R \Rightarrow R = \frac{0.08}{0.4} = 0.2\,k\Omega \approx 200\,\Omega$$

4.59



$\Delta V = 1V$, $V_0 = V_{Z0} + I_Z R_Z$ $R_Z = 5\Omega$

$$\Delta V_0 = \frac{R_Z}{R_Z + 82}(\Delta V)$$

$$= 1\left(\frac{5}{5+82}\right) = 0.057\text{ V}$$

ΔV_0 → change in regulated output voltage