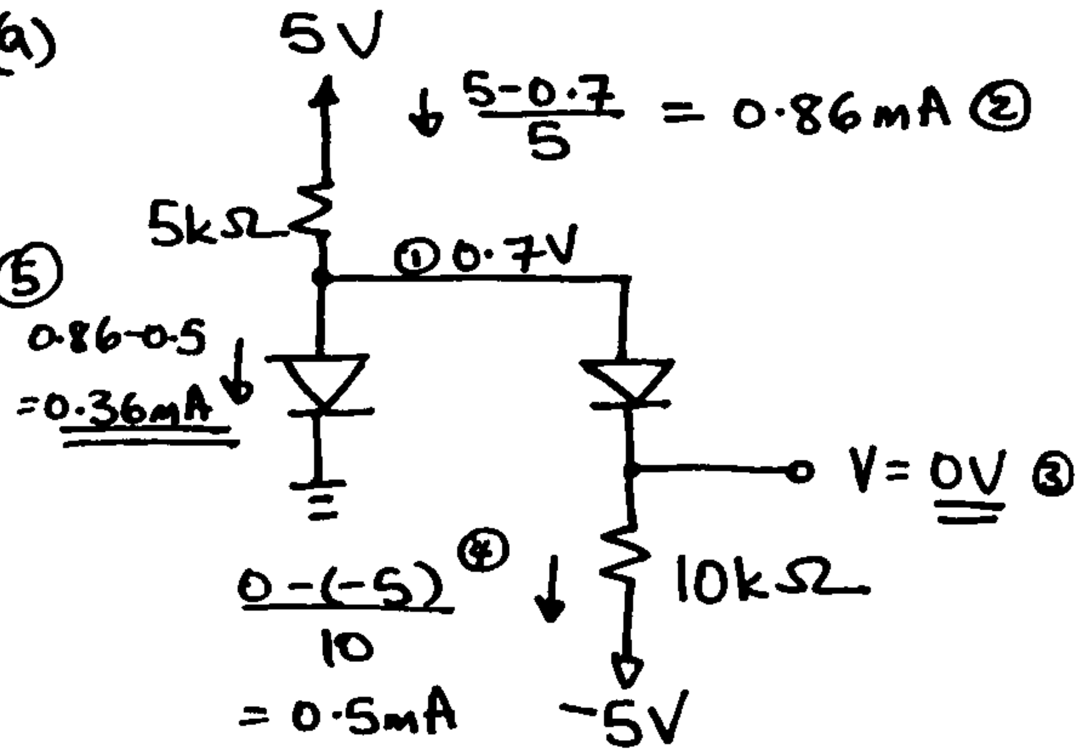
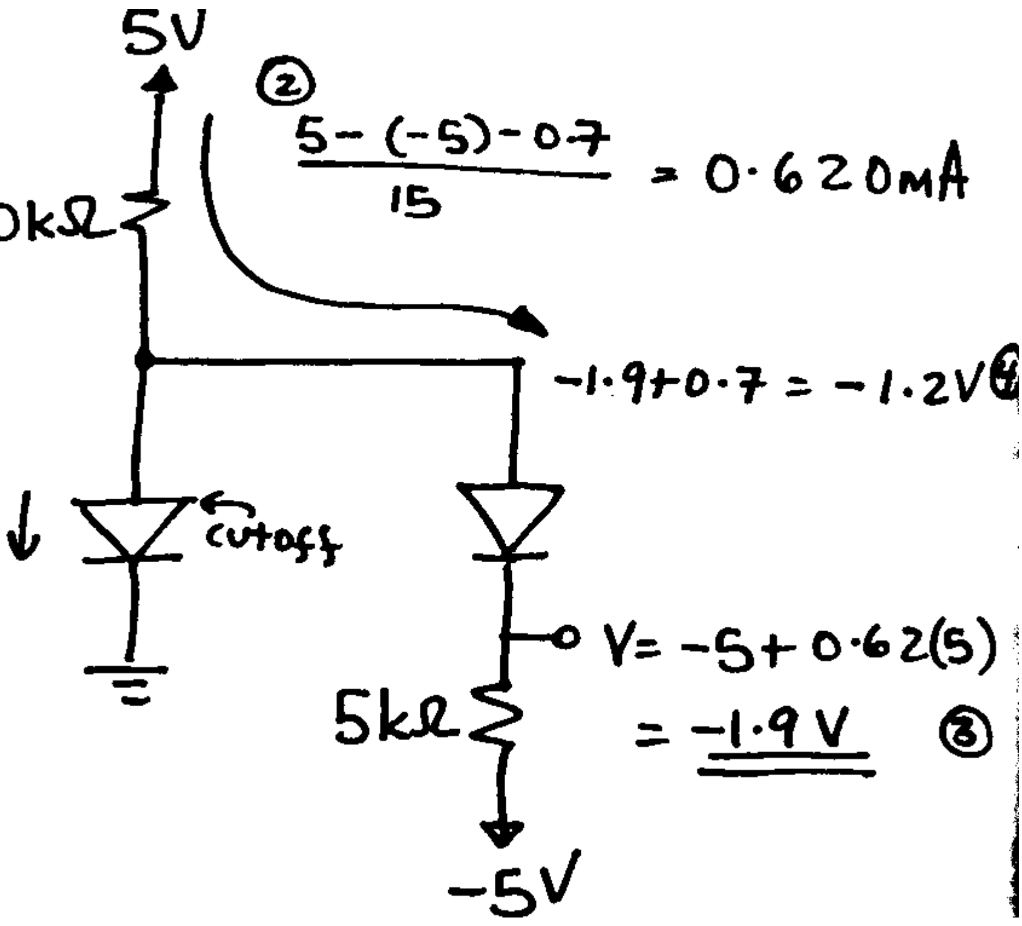
HW2

3.48

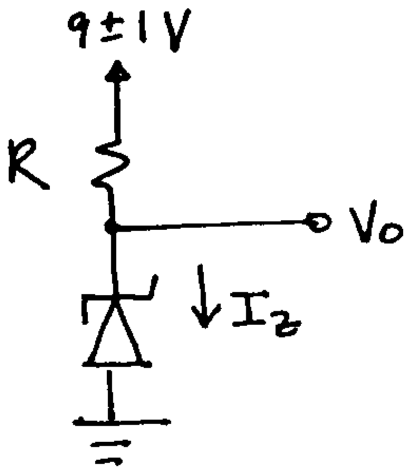
(a)


5V
5−0.7 / 5 = 0.86mA ②
5kΩ
① 0.7V
⑤
0.86−0.5 =0.36mA
V= 0V ③
0−(−5) / 10 = 0.5mA ④
10kΩ
−5V

(b)


5V
②
5−(−5)−0.7 / 15 = 0.620mA
10kΩ
−1.9+0.7 = −1.2V ④
①
0A
cutoff
V= −5+0.62(5)
= −1.9V ③
5kΩ
−5V

3.69



GIVEN PARAMETERS

$V_Z = 6{\cdot}8\text{V},\ r_Z = 5\,\Omega,$
$I_Z = 20\,\text{mA}$

By knee

$I_{ZK} = 0{\cdot}25\,\text{mA}$
$r_Z = 750\,\Omega$

FIRST DESIGN – 9V supply can easily supply current.

Let $I_Z = 20\,\text{mA}$ ~ well above knee

$$\therefore R = \frac{9 - 0{\cdot}68}{20} = \underline{\underline{110\,\Omega}}$$

$$\text{Line Regulation} = \frac{\Delta v_O}{\Delta v_S} = \frac{r_Z}{r_Z + R}$$

$$= \frac{5}{5 + 110}$$

$$= \underline{43{\cdot}5\ \frac{\text{mV}}{\text{V}}}$$

SECOND DESIGN ~ limited current from 9V supply

$I_Z = 0{\cdot}25\,\text{mA}$

$V_Z = V_{ZK} \simeq V_{Z0}$ – calculate V_{Z0} from

$$V_Z = V_{Z0} + r_Z I_{ZT}$$

$$6.8 = V_{Z0} + 5 \times 0.02$$

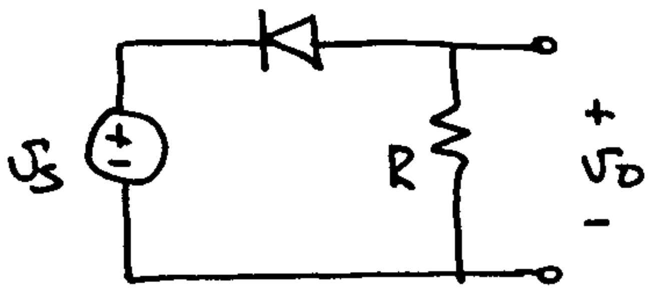
$$V_{Z0} = 6.7V$$

$$\therefore R = \frac{9-6.7}{0.25} = \underline{\underline{9.2k\Omega}}$$

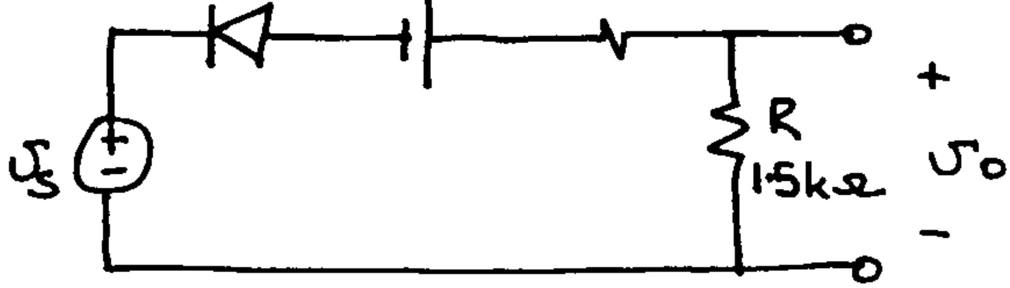
$$\text{LINE REGULATION} = \frac{\Delta v_O}{\Delta v_S} = \frac{750}{750+9200}$$

$$= \underline{75.4 \frac{mV}{V}}$$

3.72

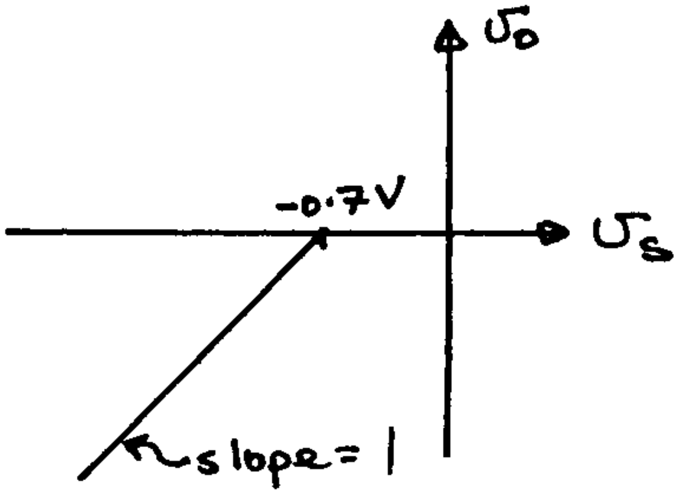


Using the constant voltage drop model:

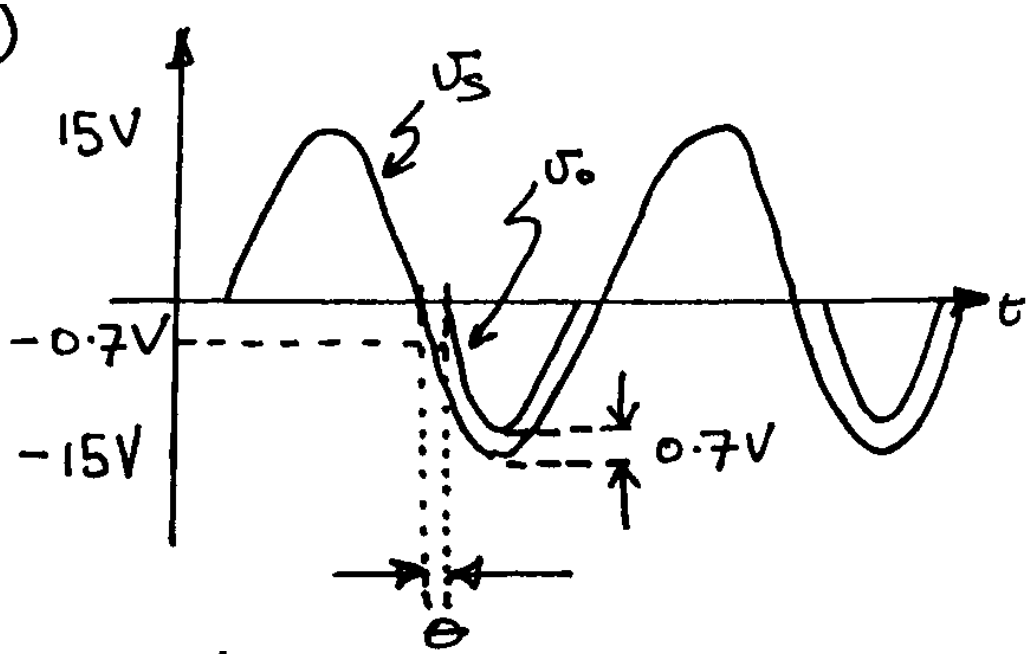


(a) $v_o = v_s + 0.7\ V$, for $v_s \leq -0.7V$

$v_o = 0$, for $v_s \geq -0.7V$



(b)



(c) The diode conducts at an angle

$\theta = \sin^{-1} \frac{0.7}{15} = 2.67^\circ$ & stops

at $\pi - \theta = 177.33^\circ$

Thus the conduction angle is $\pi - 2\theta$
$= 174.66°$ or 3.05 rad.

$$v_{o,avg} = \frac{-1}{2\pi} \int_{\theta}^{\pi-\theta} 15 \sin\phi - 0.7 \, d\phi$$

$$= \frac{-1}{2\pi} \Big[-15 \cos\phi - 0.7\phi \Big]_{\theta}^{\pi-\theta}$$

$$= \frac{-1}{2\pi} \Big[15 \times 2 \cos\theta - 0.7(\pi - 2\theta) \Big]$$

$= \underline{\underline{-4.43V}}$

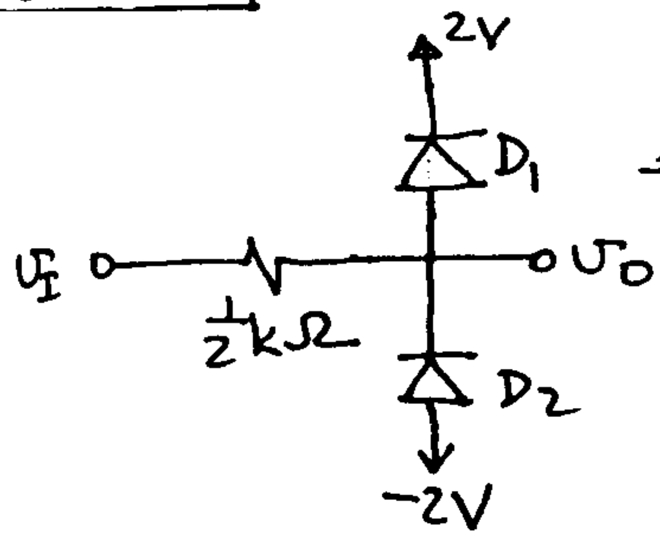
(d) Peak current in diode is:

$$\frac{15-0.7}{1.5\times10^3} = \underline{\underline{9.5\,mA}}$$

(e) PIV occurs when v_s is at its +ve peak and $v_o = 0$.

$PIV = \underline{\underline{15V}}$

3.95



$-2.5 \leq v_I \leq 2.5$

~ both D_1 & D_2 off

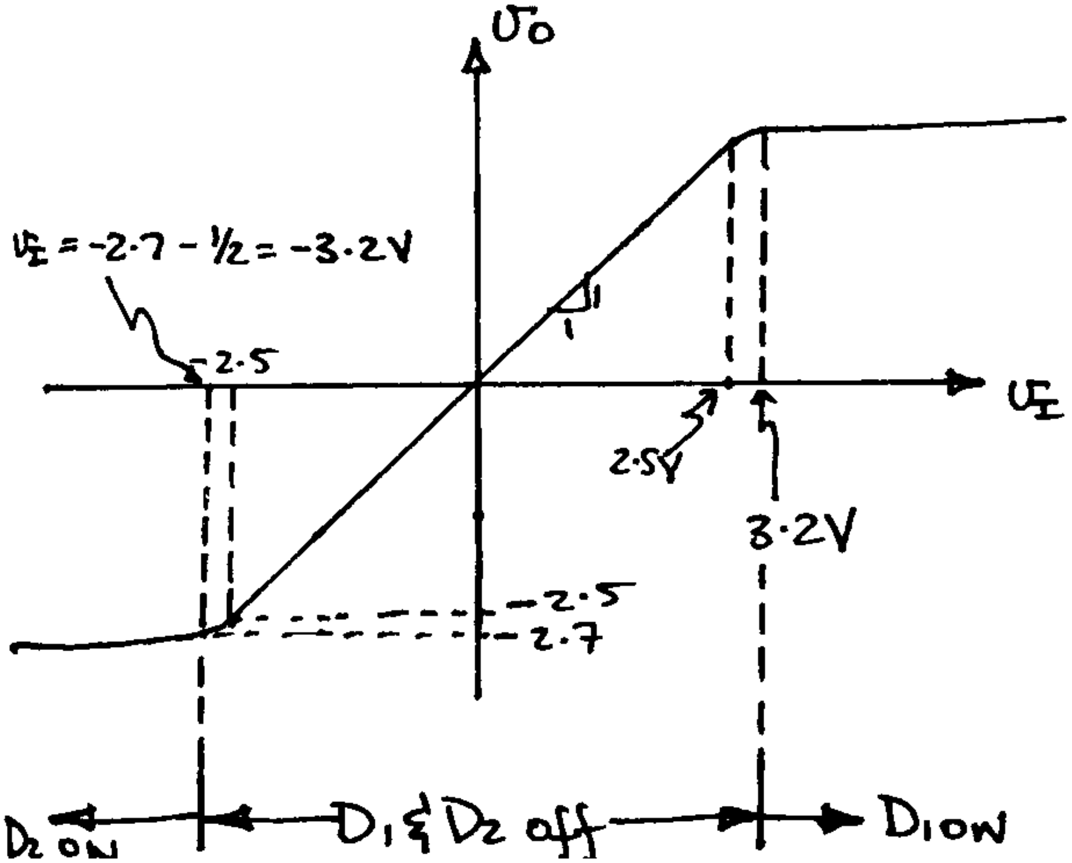
$- v_o = v_I$

for $v_I \geq 2.5V$ ~ D_1 on

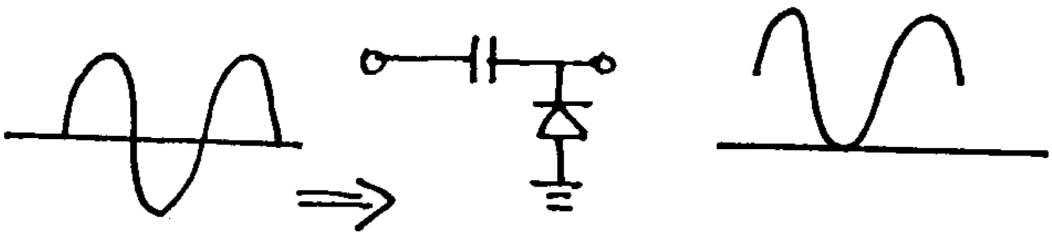
$v_{D1} = 0.7$ at $i_{D1} \geq 1mA$

$v_o = 2.7V$ at $v_I = 2.7 + \frac{1}{2}\times 1$

$= \underline{3.2V}$



3.104



10V rms

$10\sqrt{2}$ V, peak

Average (dc) value of output $= 10\sqrt{2}$

$= \underline{\underline{14.14V}}$