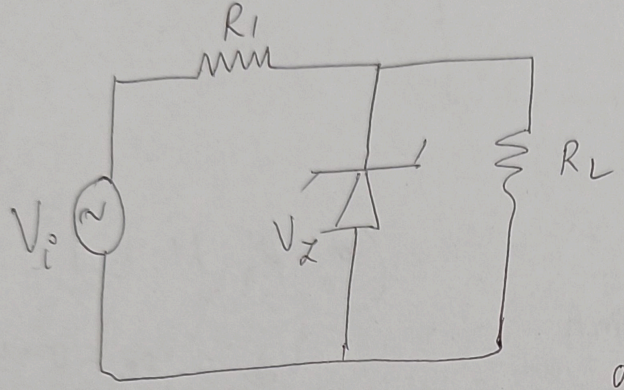
CSET102

Quiz 5 Solutions

(1)



$V_i = 14.4 \sin(\omega t)$

Since $V_Z = 7.4V$

at the output → in positive half cycle $V_{out} = V_Z = 7.4V$

in negative half cycle → Zener diode is forward biased & it behaves as a PN Junction diode, so $V_{out} = 0.7V$ (cut in voltage of Si diode)

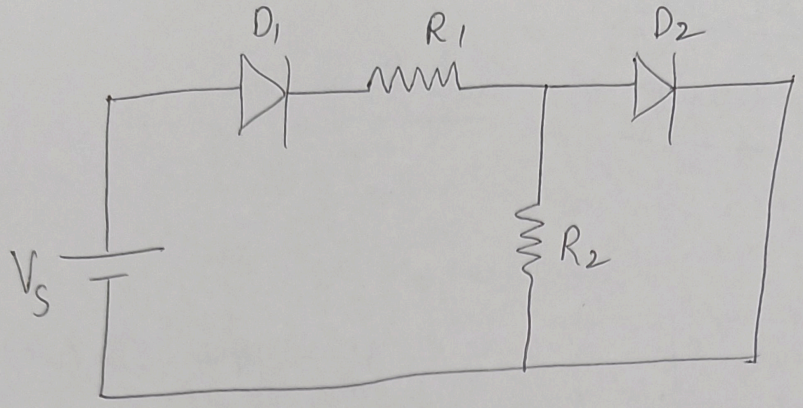
(2)

$$I_d = I_S \left[e^{\frac{V_d}{nV_t}} - 1 \right]$$

$$= 59 \times 10^{-15} \left[e^{\frac{0.65}{0.026}} - 1 \right]$$

$$I_d = 4.81 \text{ mA}$$

(3)

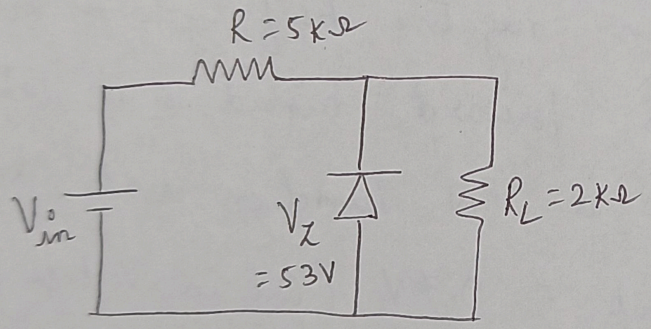


$$R_2 = \frac{V_{R_2}}{I_{R_2}} = \frac{0.7V}{12mA} \qquad (\because R_2 \parallel D_2)$$

$$V_{R_2} = V_{D_2} = 0.7V$$

$$R_2 = 58.33\,\Omega$$

(4)



$I_{d\,max} = ?$

$I_{d\,min} = ?$

$V_{in} = 170 - 230V$

$V_{R_L} = V_z = 53V \Rightarrow i_{R_L} = \frac{V_{R_L}}{R_L} = \frac{53}{2K} = 26.5\,mA$

$V_{in} = V_R + V_z \Rightarrow V_{in,min} = V_{R,min} + V_z \Rightarrow V_{R,min} = 170 - 53 = 117V$

$V_{in,max} = V_{R,max} + V_z \Rightarrow V_{R,max} = 230 - 53 = 177V$

$i_{R,min} = \frac{V_{R,min}}{R} = \frac{117V}{5K} = 23.4\,mA$

$i_{R,max} = \frac{V_{R,max}}{R} = \frac{177}{5K} = 35.4\,mA$

$i_R = i_z + i_{R_L} \Rightarrow i_z = i_R - i_{R_L} \Rightarrow i_{z,max} = i_{R,max} - i_{R_L} = 8.9\,mA$

$i_{z,min} = i_{R,min} - i_{R_L} = -3.1\,mA$