ENEE 2360 Ch 2 Homework Solution Part 2

Problem 1: $V_{Lr,p-p} = \frac{V_m}{2 f_o R_L C} = 8.33\,V\ p\text{-}p$

$$V_{L,dc} = V_m \left(1 - \frac{1}{4 f_o R_L C} \right) = 25.8\,V$$

$$r = \frac{\frac{V_{Lr,p-p}}{2\sqrt{3}}}{V_{L,dc}} \times 100\,\% = 9.32\,\%$$

Problem 2: $r = \frac{1}{\sqrt{3}\left(4 f_o R_L C - 1\right)} = 0.01$

$$\therefore C = 163.153\,\mu F$$

Problem 3:

$$r = \frac{1}{\sqrt{3}\left(4 f_o R_L C - 1\right)} \times 100\,\%$$

$$r = 2.51\,\%$$

Problem 4:

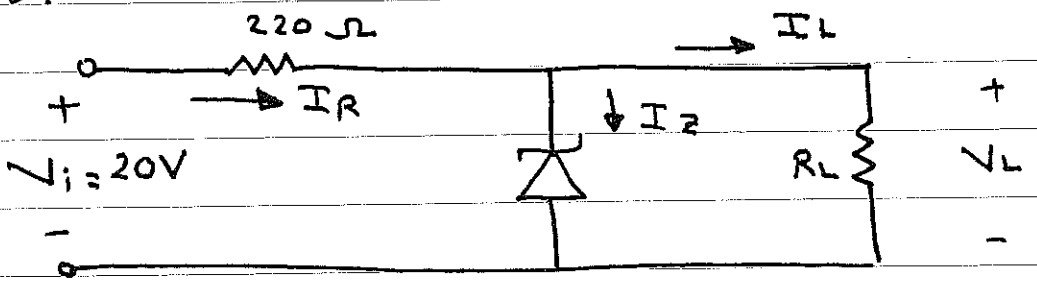
$$V_{m(sec)} = (\sqrt{2})(36) = 50.9\,V$$

$$V_{m(rec)} = V_{m(sec)} - 1.4 = 49.5\,V$$

$$V_{Lr,p-p} = \frac{V_{m(rec)}}{2 f_o R_L C} = 1.25\,V$$

$$V_{L,dc} = V_{m(rec)} \left(1 - \frac{1}{4 f_o R_L C} \right) = 48.9\,V$$

Problem 5:



$V_Z = 10V$ and $P_{Z,max} = 400mW$

$\therefore I_{Z,max} = 40mA$

a) For $R_L = 180\Omega$

$R_{TH} = 220\Omega \parallel 180\Omega = 99\Omega$

$$V_{TH} = \frac{180\Omega}{180\Omega + 220\Omega} \cdot 20V = 9V$$

Since $V_{TH} < V_Z$, the Zener diode is open circuit

$V_L = 9V$

$$I_L = I_R = \frac{20V}{220\Omega + 180\Omega} = 50mA$$

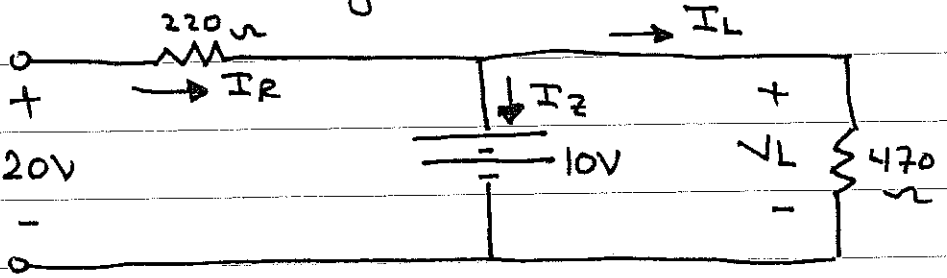
$I_Z = 0$

b) for $R_L = 470\Omega$

$R_{TH} = 470\Omega \parallel 220\Omega \cong 150\Omega$

$$V_{TH} = \frac{470}{470 + 220} \cdot 20V = 13.62V$$

Since $V_{TH} > 10V$ $\therefore$ the Zener diode is in the breakdown region



$V_L = V_Z = 10V$

$$I_L = \frac{V_L}{R_L} = 21.28mA$$

$$I_R = \frac{20 - 10}{220} = 45.45mA$$

$I_Z = I_R - I_L$

$I_Z = 24.17mA$

c) For $I_z = I_{z,max} = 40mA$

$\therefore I_L = I_{L,min} = I_R - I_{z,max}$

$\therefore I_{L,min} = 45.45 - 40 = 5.45mA$

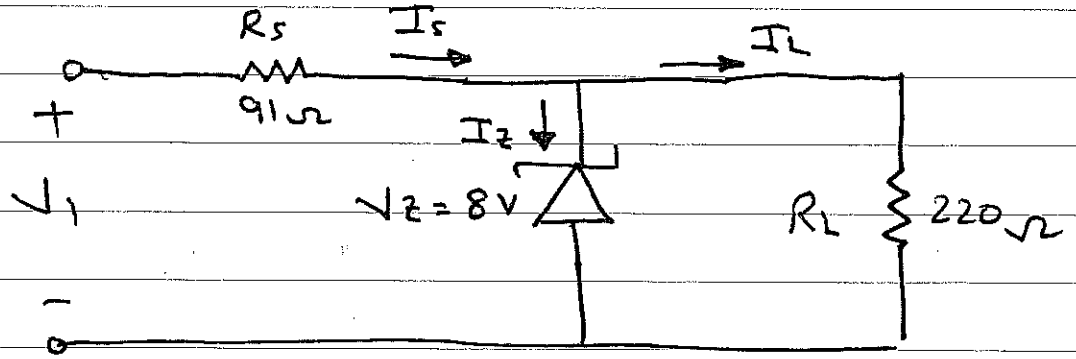
$\therefore R_L = \frac{V_L}{I_{L,min}} = \frac{10}{5.45} = 1835\ \Omega$

d) $10 = \frac{R_L}{R_L + 220} \cdot 20V$

$\therefore R_L = 220\ \Omega$

$\therefore R_{L,min} = 220\ \Omega$

Problem 6:



$P_{z,max} = V_z I_{z,max} = 400mW$

$\therefore I_{z,max} = 50mA$

$I_S = I_z + I_L$

$I_{S,max} = I_{z,max} + I_L$

$I_L = \frac{V_z}{R_L} = \frac{V_L}{R_L} = 36.364mA$

$$I_{S,max} = I_{Z,max} + I_L$$

$$I_{S,max} = 50mA + 36.364mA = 86.364mA$$

$$I_S = \frac{V_i - V_Z}{R_S}$$

$$I_{S,max} = \frac{V_{i,max} - V_Z}{R_S}$$

$$\therefore V_{i,max} = 15.86V$$