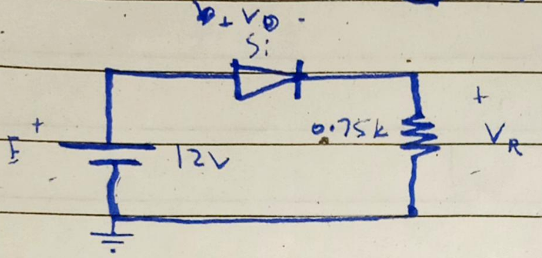
Assignment - 1

Name:- Aliyan Ahmed Cheema

Reg # FA22-BCE-028 (B)

Q- 1



Applying KVL,

$$-E + V_D + V_R = 0$$

$$V_D + I_D R = 12$$

$$V_D + I_D \times 0.75 = 12$$

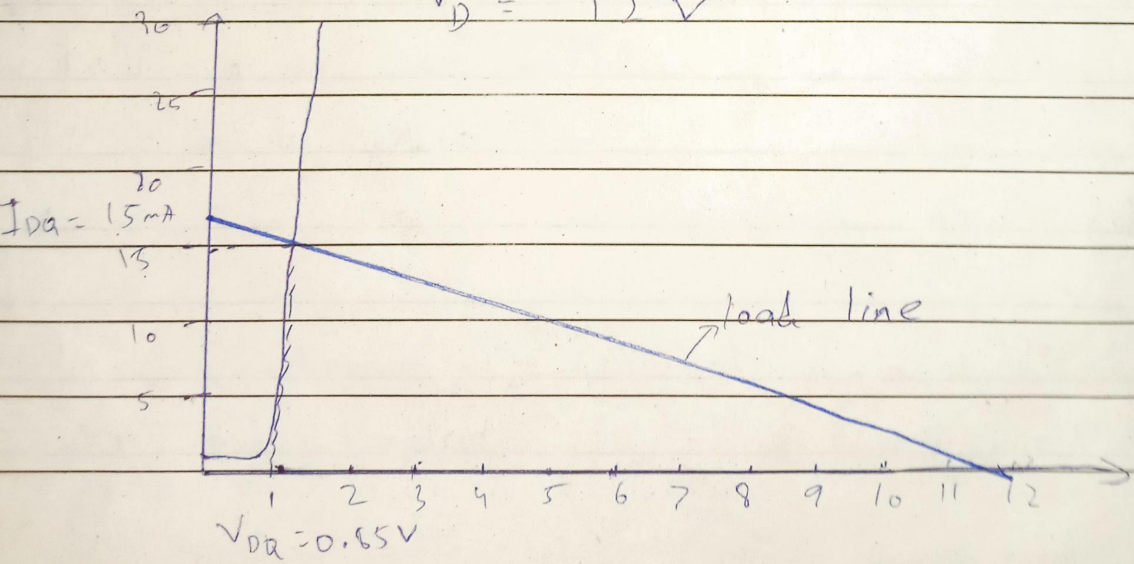
To draw load line, first we ~~Fih~~ find I_D

when $V_D = 0$

$$0.75\ I_D = 12 \Rightarrow I_D = 16\,mA$$

when $I_D = 0$

$$V_D = 12\,V$$



From the graph, we see that V_D and I_D at point Q is,

$V_{DQ} = \boxed{0.85\,V}$

$I_{DQ} = \boxed{15\,mA}$

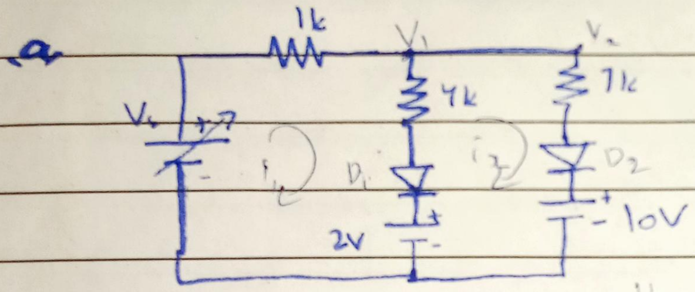
$V_R = E - V_{DQ}$

$= 12 - 0.85$

$= \boxed{11.15\,V}$

Q-2

a)



At V_1,

$V_o = V_1 - 2V$

At V_2,

$V_o = V_2 - 10V$

Hence, the voltage across V_1 to turn the diode D_1 on is 2.7 whereas for V_2 is 10.7, since they are in parallel we will apply 10.7V as V_o.

$V_s = V_{\text{1kR}} + 10 + V$

$V_s \approx 12\,V$

b)

Using Mesh Analysis

M_1,

$-20 + 1000\,i + 4000(i_1 - i_2) + 0.7 + 2 = 0$

$-20 + 1000\,i + 4000\,i_1 - 4000\,i_2 + 0.7 + 2 = 0$

$$5000\, i_1 - 4000\, i_2 = 17.3$$

M_2,

$$-2 - 0.7 + 4000\,(i_2 - i_1) + 7000\, i_2 + 0.7 + 10 = 0$$

$$-2 - \cancel{0.7} + 4000\, i_2 - 4000\, i_1 + 7000\, i_2 + \cancel{0.7} + 10 = 0$$

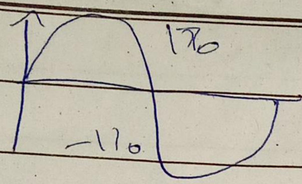
$$-4000\, i_1 + 11000\, i_2 = -8$$

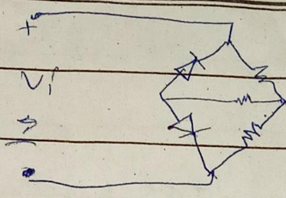
$i_1 = 4.05\, mA$ $\quad$ $i_2 = 0.149\, mA$

$$I_{D_1} = i_1 - i_2 = 3.3\, mA$$

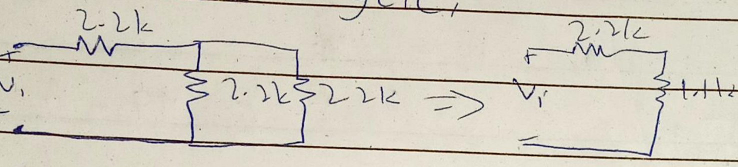
$$I_{D_2} = 0.749\, mA$$

Q3



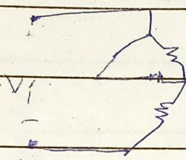


For +ve cycle,

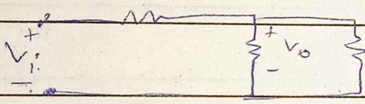


$$V_o = \frac{1.1}{1.1 \times 2.2} \times 70 = 56.67V$$

For -ve cycle,

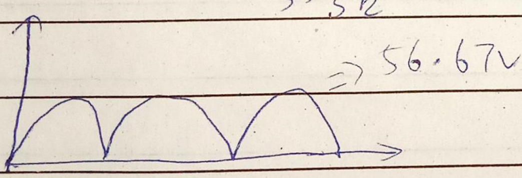


$\therefore V_i = -170V$



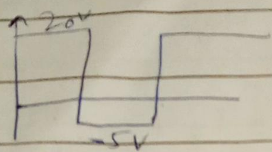
Adding the resistance in parallel & Apply VD

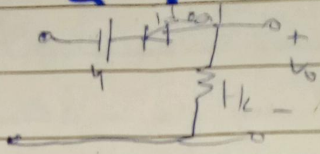
$$V_o = \frac{1.1k \times 170}{3.3k} = 56.67V$$



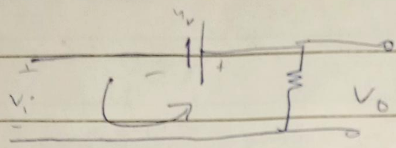
$V_{oc} = 0.636 \times 56.67 = 36.04\ V$ Ans

Q-4





The diode will work in the -ve cycle.

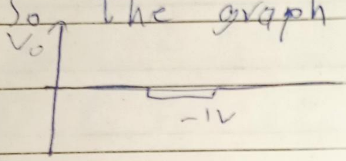


$V_i - V_o + 4 = 0$

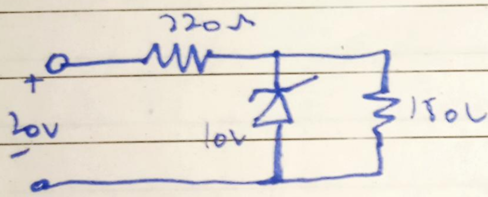
$-5 + 4 = V_o$

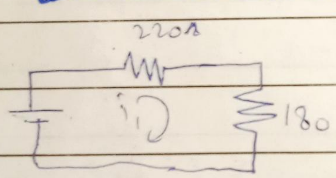
$V_o = -1V$

So, the graph will be,



Q-5





Applying KVL

$-20 + 220i + 180i = 0$

$i = 0.05 A = 50 mA$

$V_L = IR = 50 \times 10^{-3} \times 180 = 9V$

Since $9V < 10V$

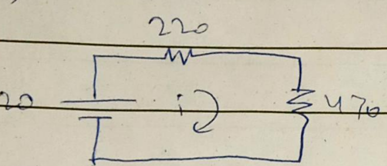
The diode will remain off

Then,

$V_L = 9V$, $I_L = 50\ mA$

$I_Z = 0A$, $I_R = 18\ mA$

b) $R_L = 470\ \Omega$



KVL,

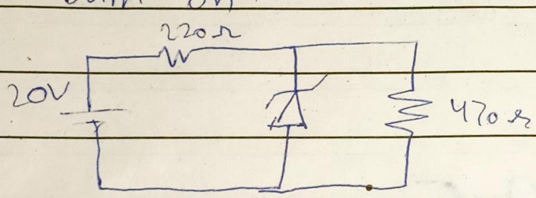
$-20 + 220i + 470i = 0$

$i = 0.02899A = 28.99\ mA$

$V_L = IR = 28.99 \times 10^{-3} \times 470$

$V_L = 13.6V$

Since $13.6 > 10$ so the diode will turn on.



$\therefore V_L = 10V$

$I_L = \frac{V}{R} = \frac{10}{470} = 0.213 = 21.28\ mA$

$I_Z = \frac{P}{V} = \frac{400 \times 10^{-3}}{10} = 40\ mA$

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

(c) $R_L = ?$ for maximum power

Find I_L :-

$P = IV$

$I_Z = \frac{400 \times 10^{-3}}{10} = 40mA$

$I_{Lmin} = I_R - I_Z = (45.45 - 40)mA$

$= 5.45mA$

$R_L = \frac{V}{I} = \frac{10}{5.45 \times 10^{-3}} = \boxed{1834.9\Omega}$

(a) $R_L = ?$ minimum value

Applying Voltage divider.

$V_L = 10 = \frac{R_L(20)}{R_L + 220}$

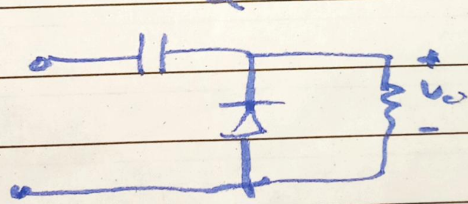
~~$10R_L + 2200$~~

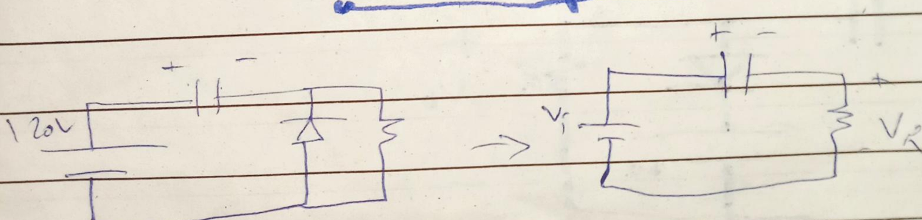
$10R_L + 2200 = 20R_L$

$10R_L = 2200$

$\boxed{R_L = 220\Omega}$

Q-6





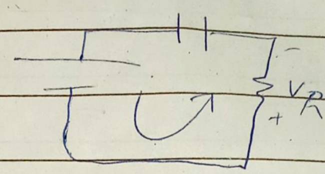
+ve cycle:-

$$-V_i + V_C + V_R = 0$$

$$V_C = 120 - V_R$$

-ve cycle:-

$$+V_i + V_R - V_C = 0$$



$$= 120 + 120 - V_R$$

$$V_R = 240 - V_R$$

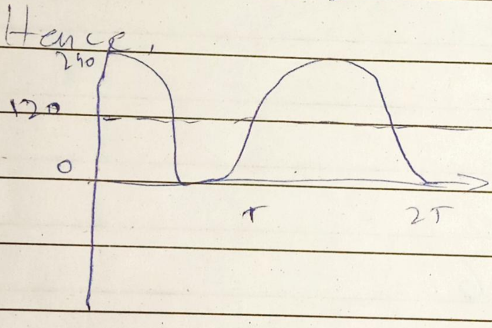
$$2V_R = 240$$

$$\boxed{V_R = 120}$$

$$V_o = 120 - V_R = 120 - 120 = 0V$$

$$V_{dc} = \frac{240 + 0}{2} = 120$$

Hence,



(b)