CMR

17.

a) $R_L = 2 \times 10^3 \Omega$

$E_{s\,rms} = 200 V$

$I_{dc} = ?$

$V_{dc} = ?$

$\gamma = ?$

$F = ?$

$E_{sm} = 200 \times \sqrt{2} = \boxed{282.84 V}$

$$I_{dc} = \frac{2 I_m}{\pi}$$

$$I_m = \frac{E_{sm}}{(R_S + r_f + R_L)}$$

$$I_m = \frac{282.84}{2 \times 10^3} = \boxed{0.141 A}$$

$$I_{dc} = \frac{2 \times 0.141}{\pi} = \boxed{0.090 A}$$

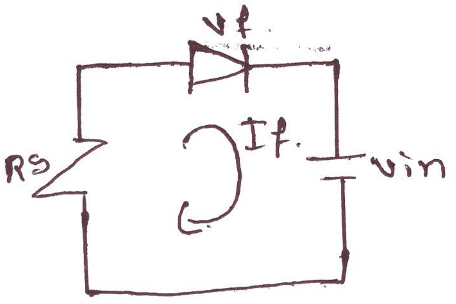
$V_{dc} = I_{dc} \times R_L$

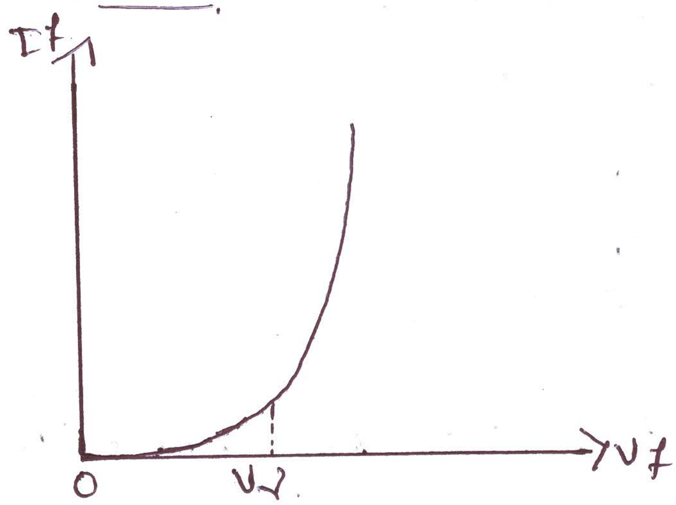
$V_{dc} = 0.090 \times 2 \times 10^3 \Omega = \boxed{180.06 V}$

$\boxed{\gamma = 0.48}$

b) V-I characterstics.

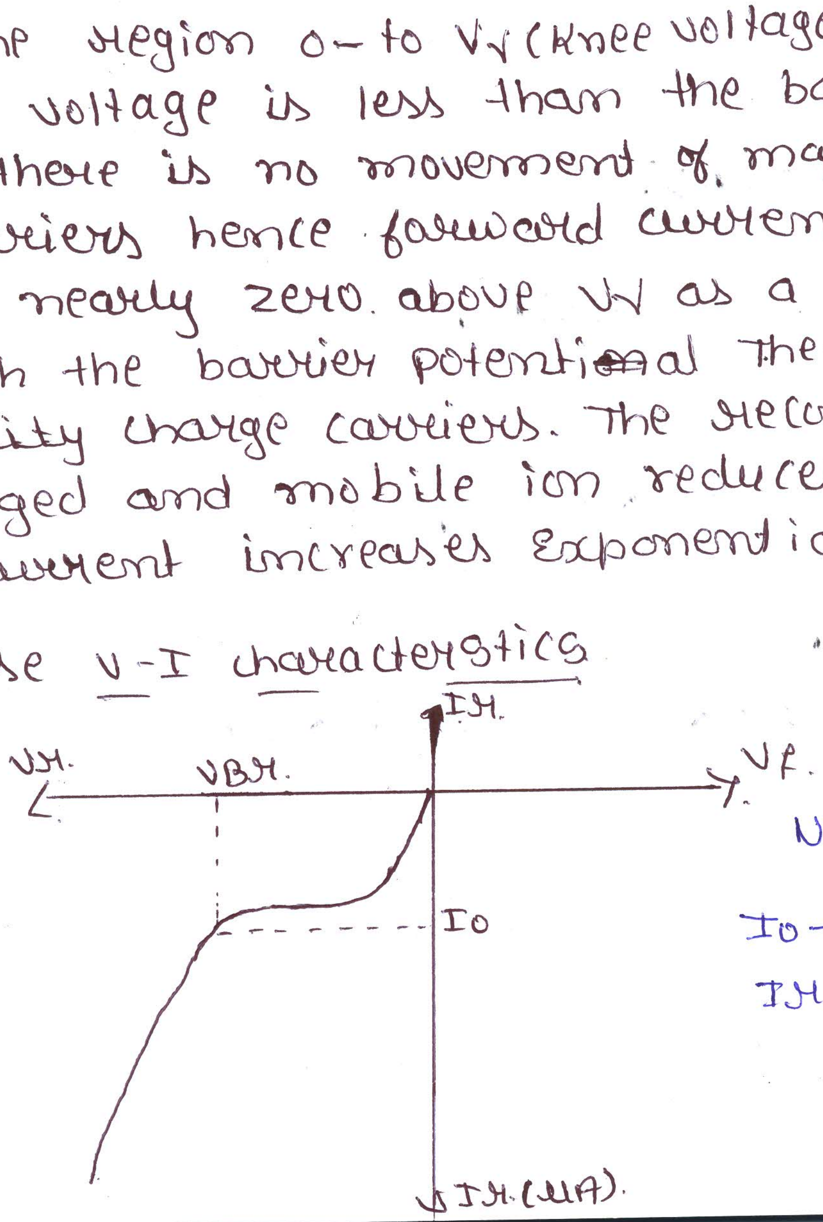
Forward V-I characterstic.





In the region 0 – to Vγ (knee voltage) as the ~~forwa~~ supply voltage is less than the barrier potential Then there is no movement of majority charge ~~ch~~ carriers hence forward current is assume to be nearly zero. above Vγ as a voltage exceed through the barrier potential the diffusion of majority charge carriers. The recombinationly arranged and mobile ion reduces due to this The current increases exponentialy.

Reverse V-I characterstics



VBR – Break down volt

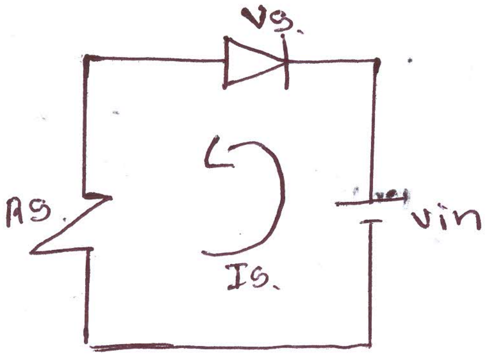
Io – saturation current

IR – reverse current

* when the Reverse voltage increases the reverse current also increases due to the presence of majority charge carriers.

* Further increasing the Reverse voltage the reverse current remains constant due to the absence of minority charge carriers.

* Further increasing the Reverse voltage the Reverse current break downs the barrier potential it may cause damage to the diode also.



56Y

a7. $I_{Z min} = 10mA$. $V_{in max} = 12 + 3 = 15V$. $V_{in min} = 12 - 3\ V = 9V$.

$I_L = 20mA$. $V_Z = 5V$. $P_{Z max} = 500mW$.

$$R_{S max} = \frac{V_{in(min)} - V_Z}{I_{L(max)} + I_{Z(min)}}$$

$$R_{S(max)} = \frac{9 - 5}{20\times10^{-3} + 10\times10^{-3}}$$

$$R_{S(max)} = 133.33\ \Omega.$$

$$P_{Z max} = V_{Z(max)} \times I_{Z(max)}$$

$$I_{Z(max)} = \frac{P_{Z(max)}}{V_{Z(max)}}$$

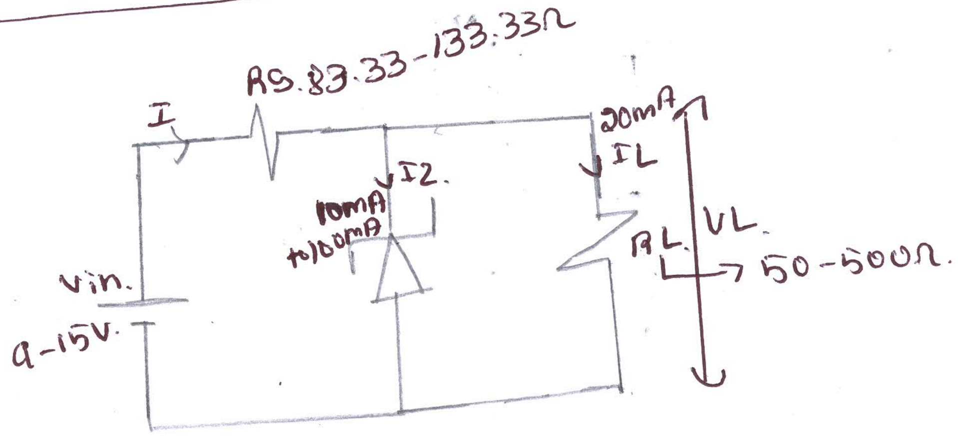
$$I_{Z(max)} = \frac{\cancel{500}\,100\times10^{-3}}{\cancel{5}}$$

$$I_{Z(max)} = 100\ mA.$$

$$R_S(min) = \frac{V_{in}(max) - V_Z}{I_L(min) + I_Z(max)}$$

$$R_S(min) = \frac{15 - 5}{20\times10^{-3} + 100\times10^{-3}}$$

$$\boxed{R_S(min) = 83.33\Omega}$$



$V = IR$

$$R_L max = \frac{V_Z}{I_{min}}$$

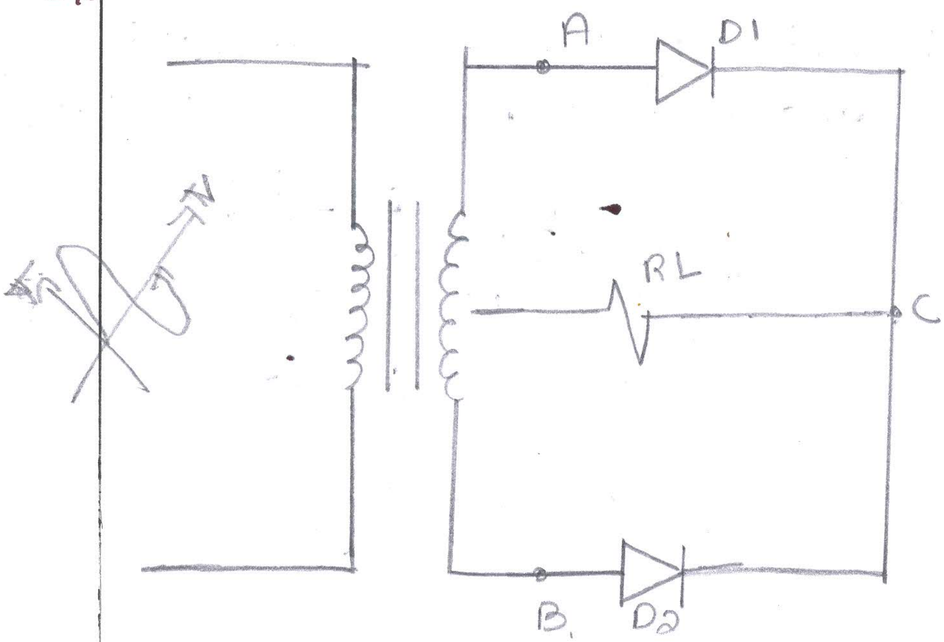
$$= \frac{5}{10\times10^{-3}}$$

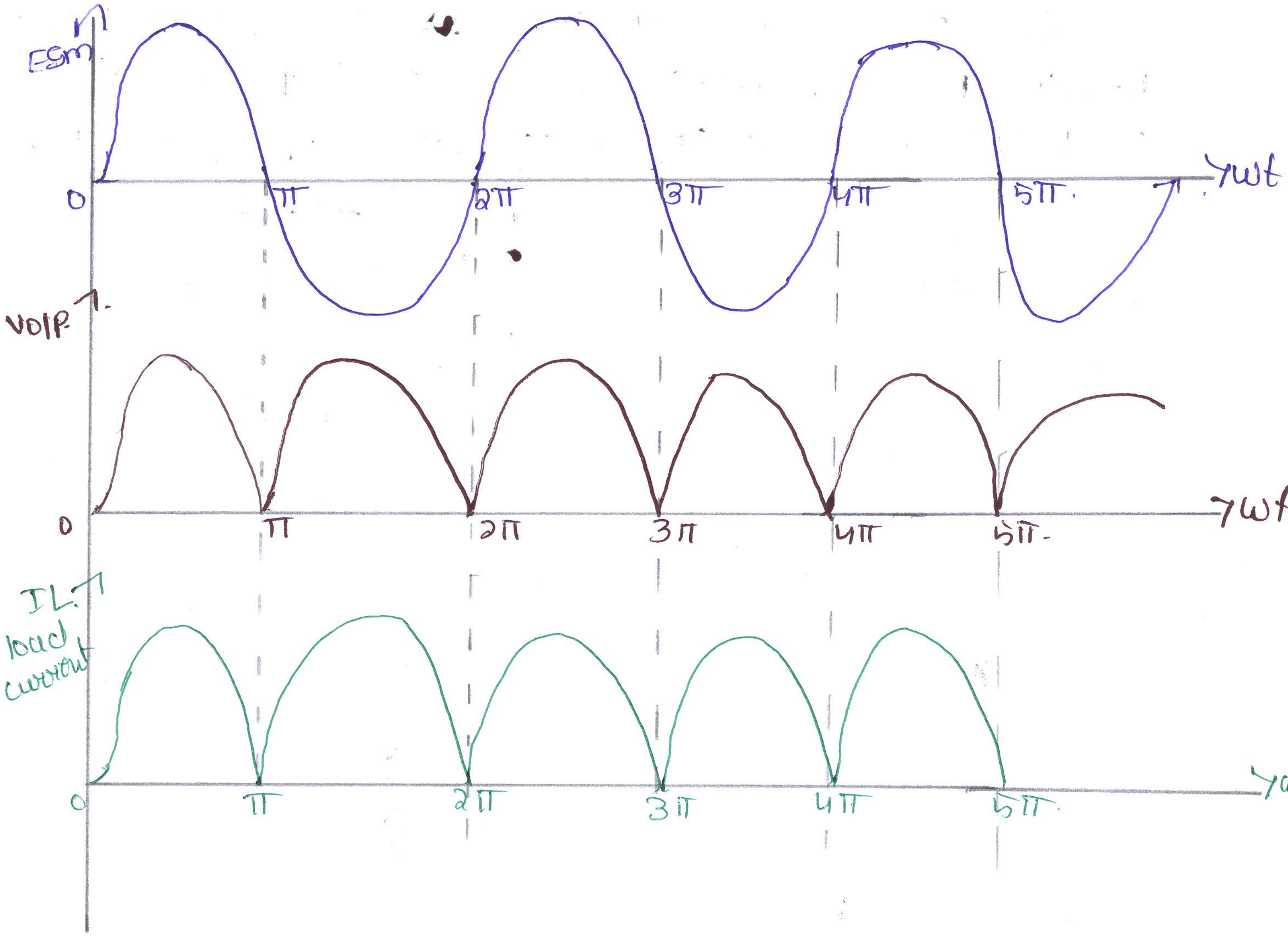
$R_L max = 500\Omega$

$$R_L min = \frac{5}{100\times10^{-3}}$$

$R_L min = 50\Omega$

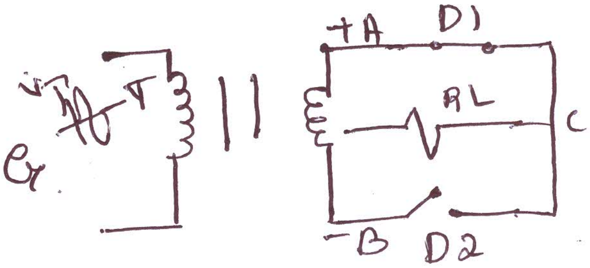
b)


A
D1
RL
C
B
D2


Esm
0
π
2π
3π
4π
5π
wt
VO/P
0
π
2π
3π
4π
5π
ωt
IL
load current
0
π
2π
3π
4π
5π

* consider a point A is positive and point B is negative so the circuit acts as a forward bias hence D_1 conducts current and D_2 doesnot conducts current so.

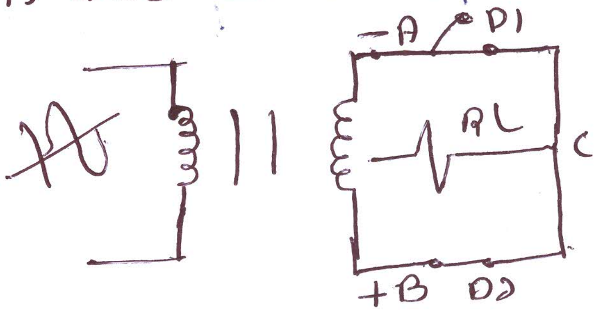
A → D_1 → C → RL → G.



so D_1 acts as a closed switch and D_2 acts as a open switch

* consider a point A is negative and point B is positive so the circuit acts as a reverse bias hence D_2 conducts current and D_1 doesnot conducts because (D_1) acts as a open switch.

B → D_2 → C → RL → G.



CMR

6Y
aY

$\beta = \frac{I_C}{I_B}$ $\alpha = \frac{I_C}{I_E}$.

$\beta = \frac{I_C}{I_B}$.

W.K.T $I_E = I_B + I_C$.

$\beta = \frac{I_C}{I_E - I_C}$. $\div$ by I_E.

$\beta = \frac{\frac{I_C}{I_E}}{1 - \frac{I_C}{I_E}}$.

$$\boxed{\beta = \frac{\alpha}{1-\alpha}}$$

$\alpha = \frac{I_C}{I_E}$

$\alpha = \frac{I_C}{I_B + I_C}$ $\div$ by I_C.

$$\boxed{\alpha = \frac{\beta}{1+\beta}}$$

$I^2_{rms} = I_{ac} + I_{dc}$.

$I^2_{rms} = (I_{ac}^2 + I_{dc})^2$.

$$I^2_{rms} = I_{ac}^2 + I_{dc}^2 + 2 I_{ac} I_{dc}.$$

$$I^2_{rms} = I_{ac}^2 + I_{dc}^2.$$

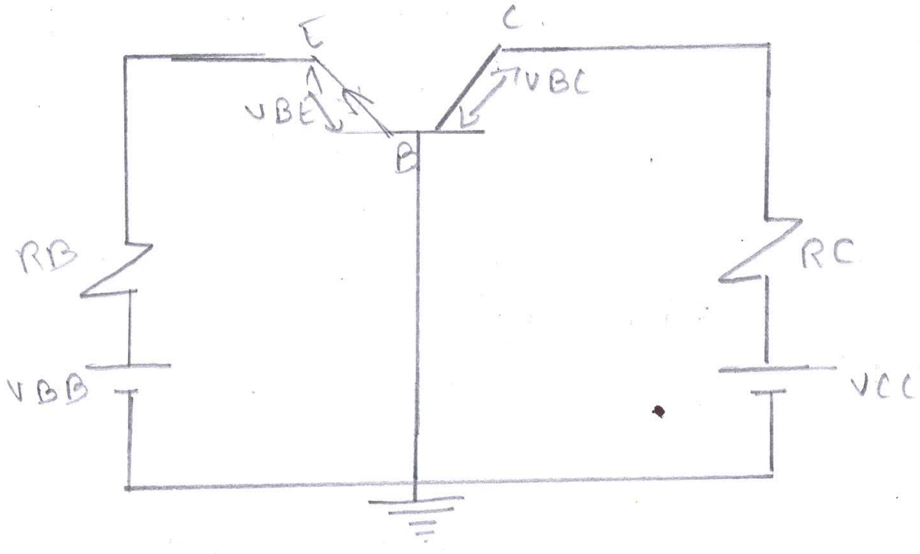
$$I_{ac}^2 = I^2_{rms} - I_{dc}^2.$$

$$\gamma = \sqrt{I^2_{rms} - I_{dc}^2}$$

$$\boxed{\gamma = \sqrt{\frac{I^2_{rms}}{I_{dc}^2} - 1}}$$

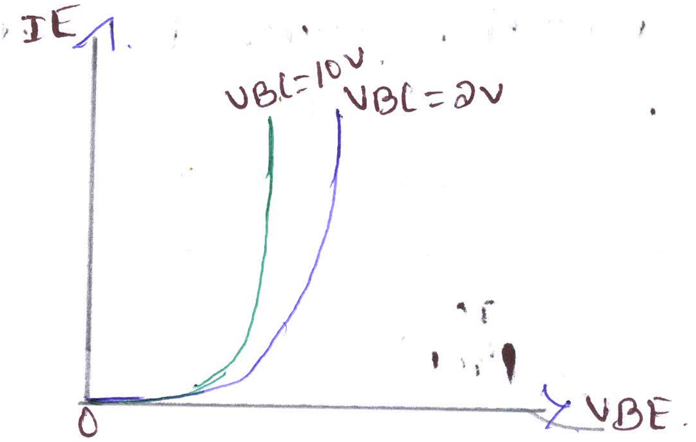
for Half wave = 1.211
for full wave = 0.48.

b7.



In CE mode consider an n-p-n transistor working in an active region.

Input characterstics

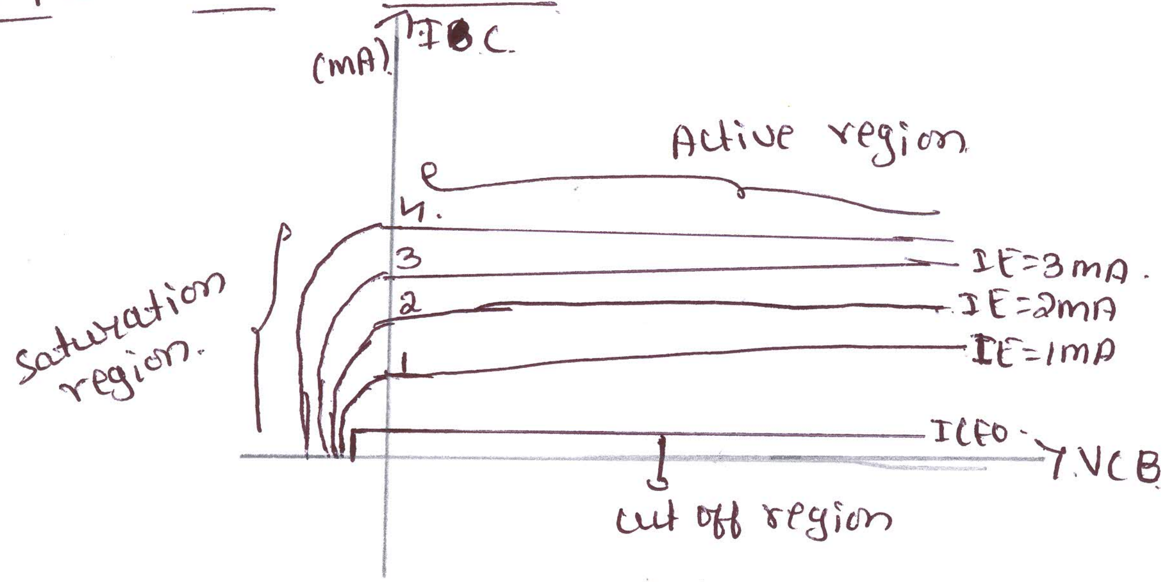


It is a graph of Input current vs Input voltage keeping output voltage as a constant.

Base width modulation.

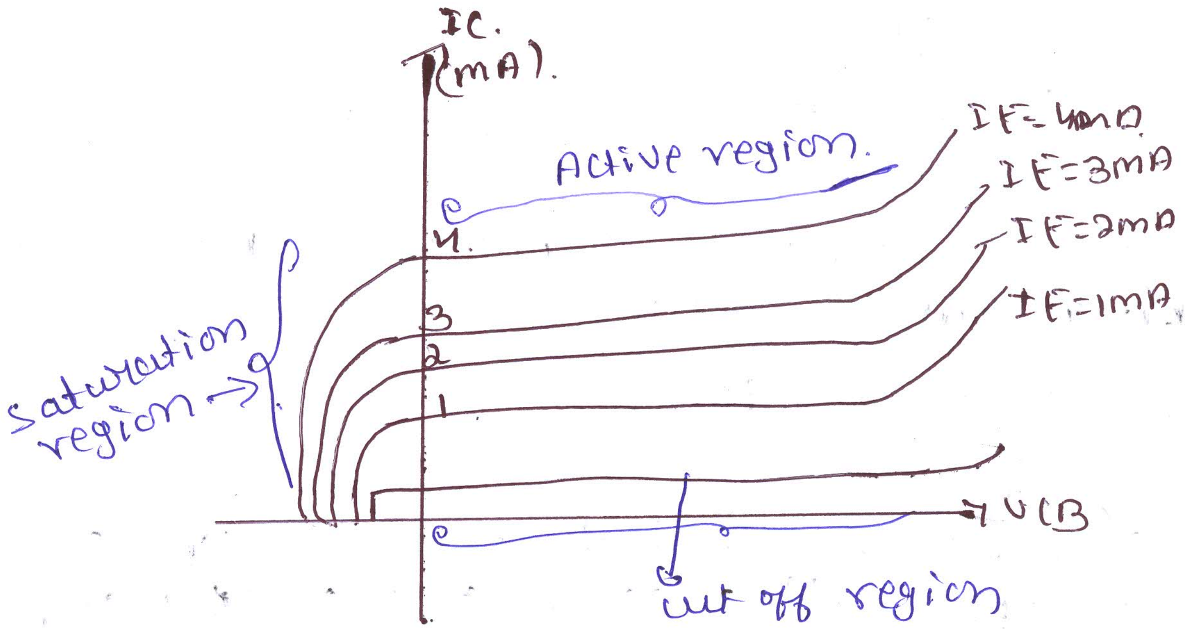
As a depletion region in CB junction increases. The electrical Base width decreases the charge concen-tration per unit area increases the Input current IE also increases.

out put. characterstics



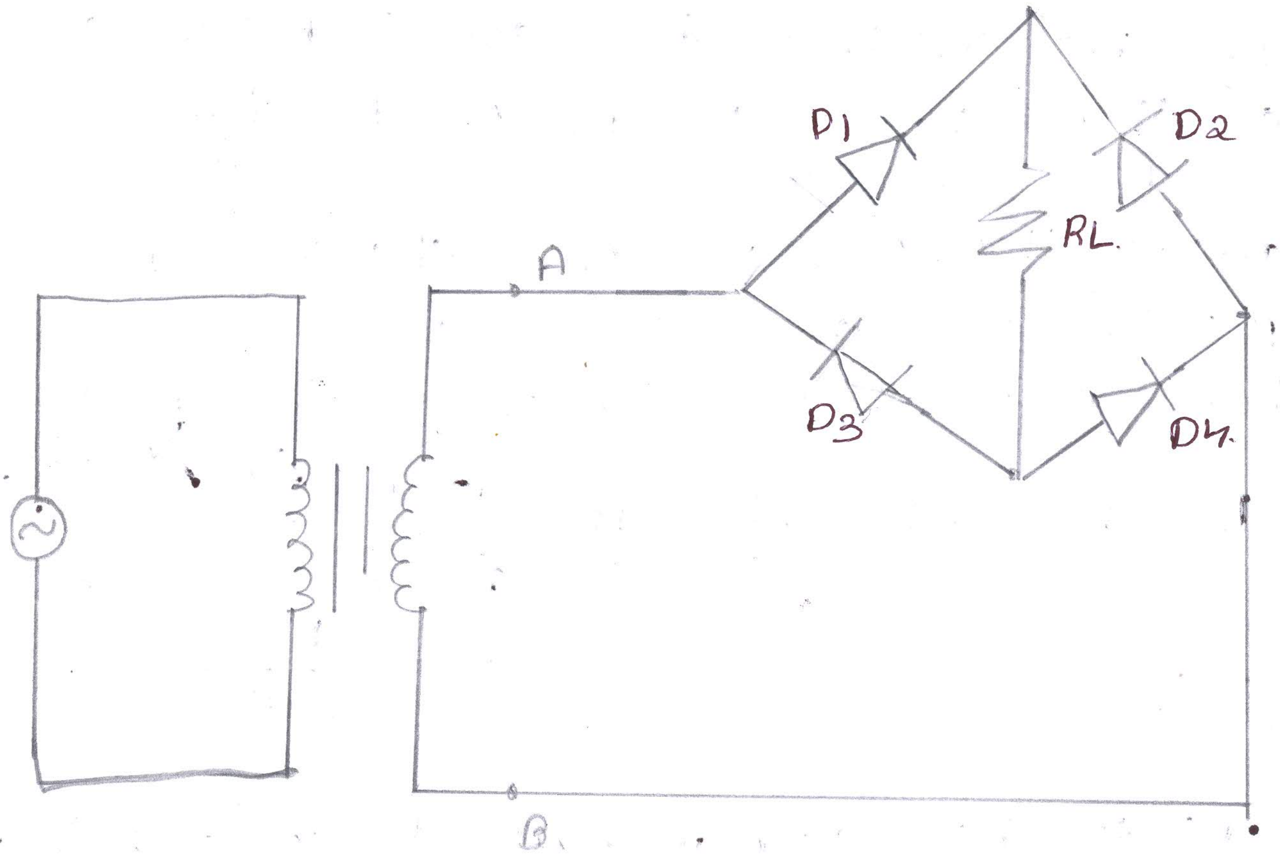
It is a graph of output voltage vs output current keeping input current as a constant.

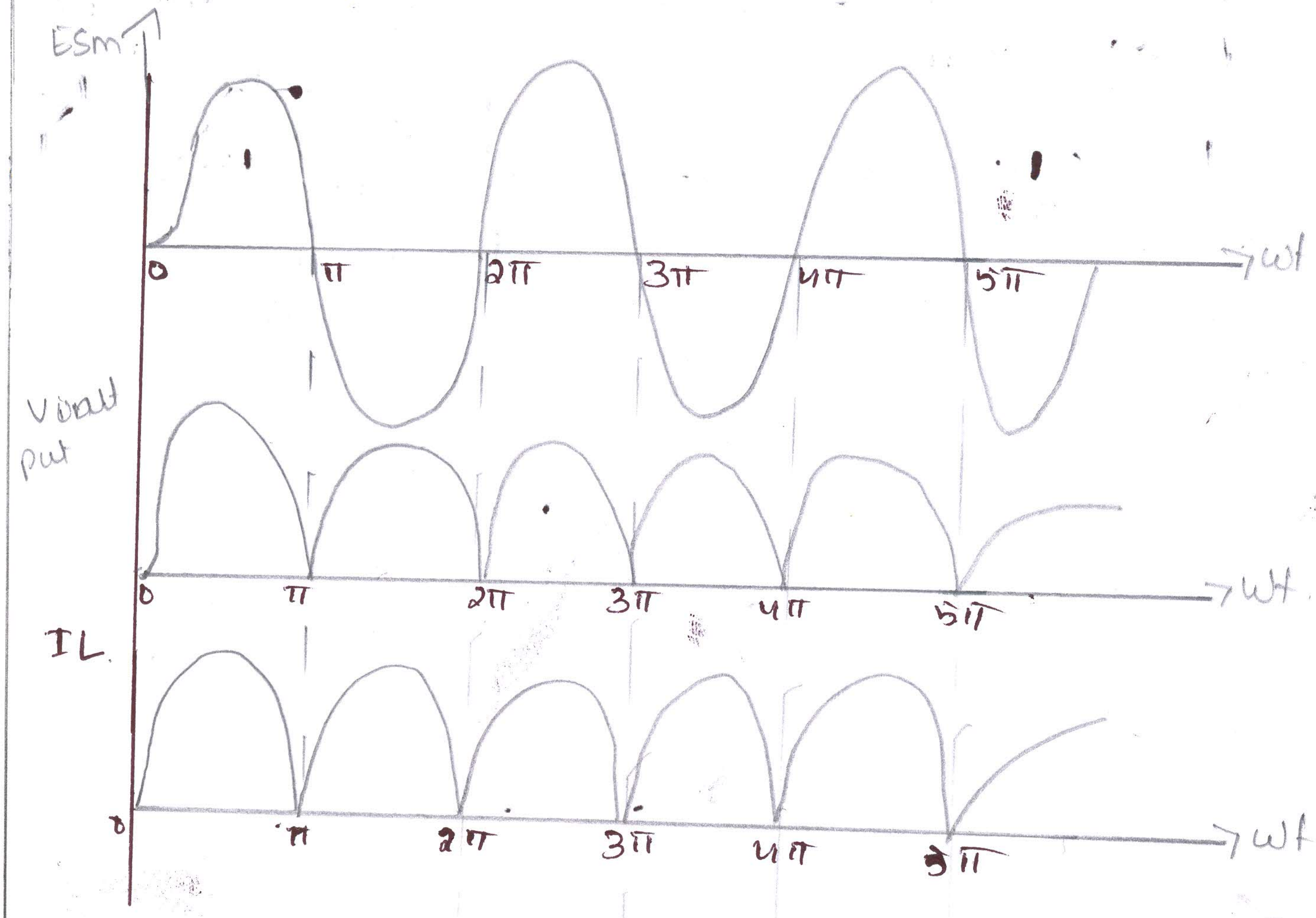
Punch through effect.
When the Dipletion Region increases across the CB junction makes Time period and contact with EB junction Due to this Effect the large current will be produced.



CMR

4.

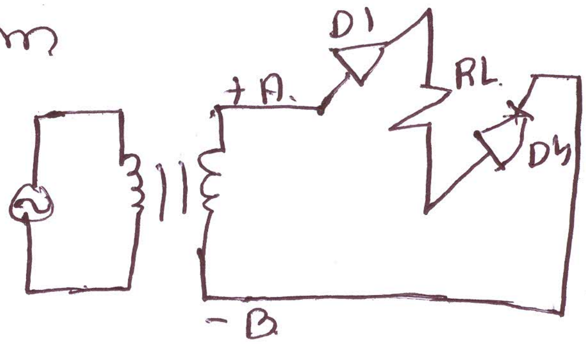

D1
D2
RL
A
D3
D4
B


Esm
0
π
2π
3π
4π
5π
ωt
Vout put
0
π
2π
3π
4π
5π
ωt
IL
0
π
2π
3π
4π
5π
ωt

In this rectifier there are 4 Diodes are ~~ar~~ there name as D1, D2, D3, D4.

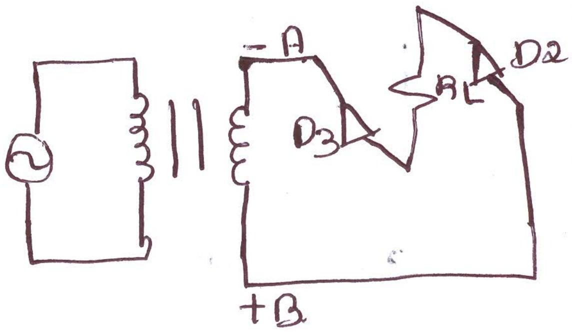
due to the forward bias the node A is positive and node B is ~~b~~ ~~negat~~ negative hence current flows from

A → D1 → RL → D4 — B.



due to the reverse bias the node A is -ve and node B is positive hence the current flows from.

B → D2 → RL → D3 — A.



$$I_{dc} = \frac{1}{2\pi}\int_0^{2\pi} I_L \, d\omega t.$$

$0 < \omega t < \pi \quad I_L = I_m \sin\omega t$

$\pi < \omega t < 2\pi \quad I_L = -I_m \sin\omega t$

$$I_{dc} = \frac{1}{2\pi}\int_0^{\pi} I_m \sin\omega t . d\omega t - \int_{\pi}^{2\pi} I_m \sin\omega t . d\omega t.$$

$$I_{dc} = \frac{I_m}{2\pi} - [\cos\pi - \cos 0] + [\cos 2\pi - \cos 0].$$

$$I_{dc} = \frac{4 I_m}{2\pi}.$$

$$\boxed{I_{dc} = \frac{2 I_m}{\pi}}$$

$$V_{dc} = I_{dc} \times R_L$$

$$V_{dc} = \frac{2 I_m}{\pi} \times R_L$$

$$\boxed{V_{dc} = \frac{2 I_m}{\pi} \times R_L}$$

$$I^2_{rms} = \frac{1}{2\pi}\int_0^{2\pi} I_m^2 \sin^2\omega t . d\omega t.$$

$$I^2_{rms} = \frac{I_m^2}{2\pi}\int_0^{\pi} 1 - \cos 2\omega t . d\omega t + 0.$$

$$I^2_{rms} = \frac{I_m^2}{2\pi}[\pi - 0] - \underbrace{[\sin 2\pi - \sin 0]}_{0}.$$

CMR

$$I_{rms} = \frac{I_m}{\sqrt{2}}$$

$P_{dc} = V_{dc} \times I_{dc}$.

$$P_{dc} = \frac{4 I_m^2}{\pi^2} \times R_L$$

$$P_{ac} = \frac{I_m^2}{2} (R_S + 2r_f + R_L)$$

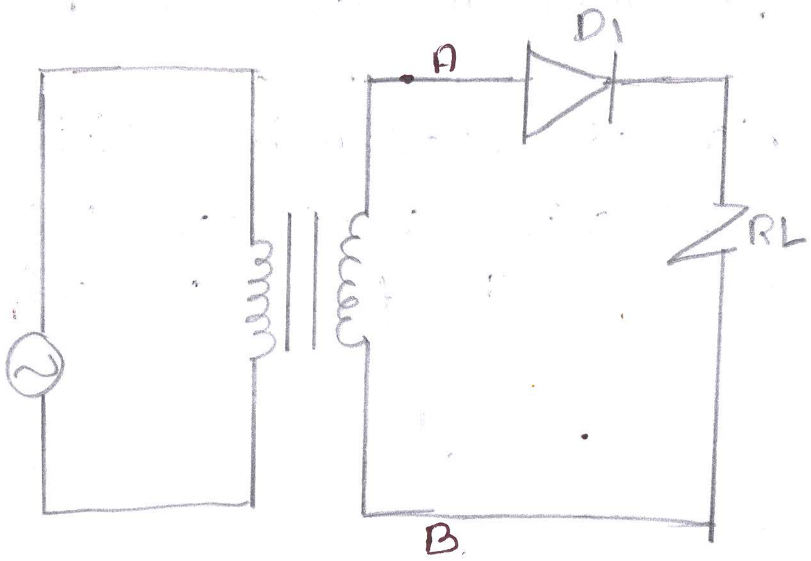
$$\eta = \frac{P_{dc}}{P_{ac}}$$

$$\eta = \frac{\frac{4 I_m^2}{\pi^2} \times R_L}{\frac{I_m^2}{2} \times (R_S + 2r_f + R_L)}$$

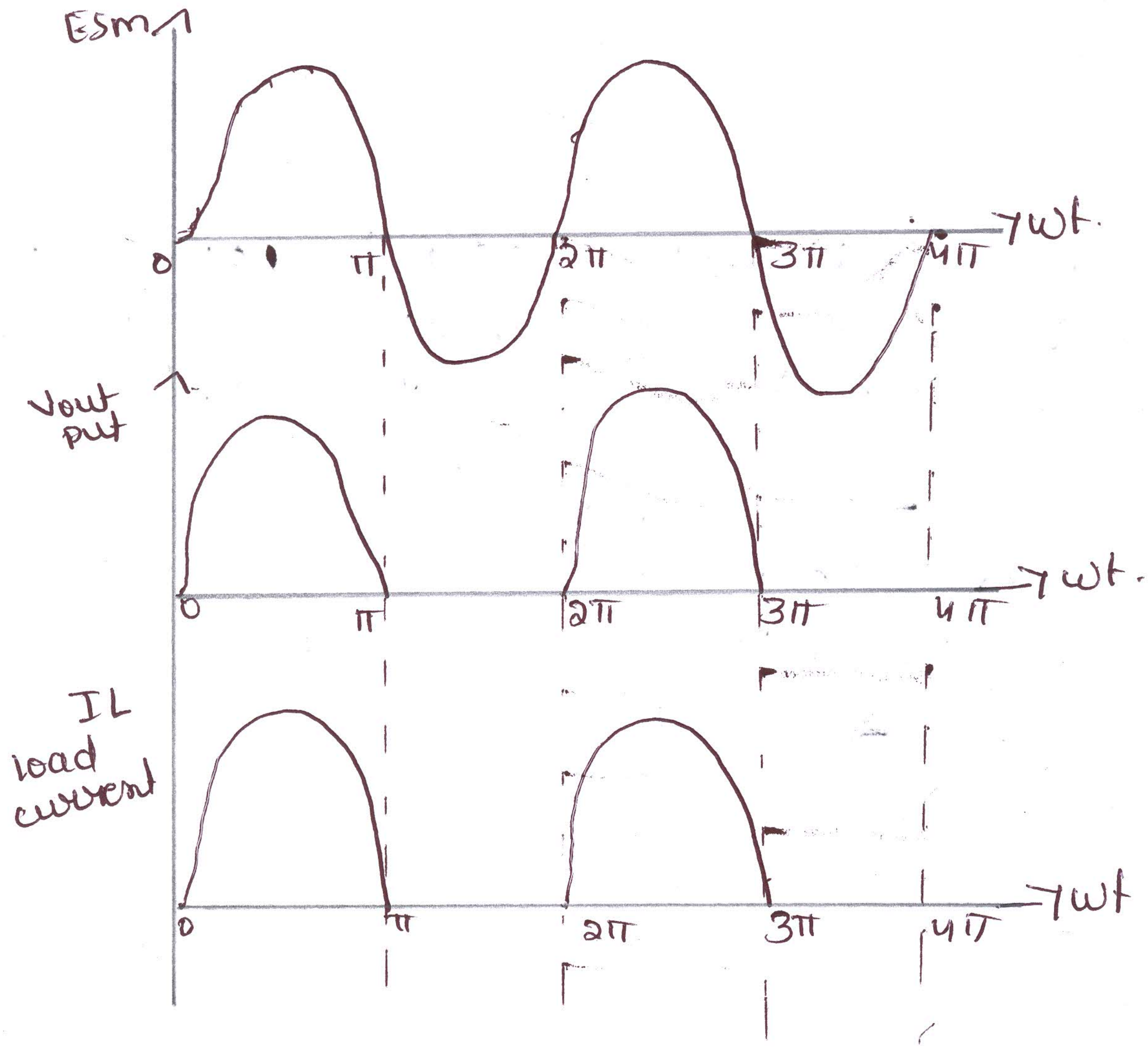
neglect << $R_S + 2r_f$

$$\eta = 80.5\%$$

3) b)



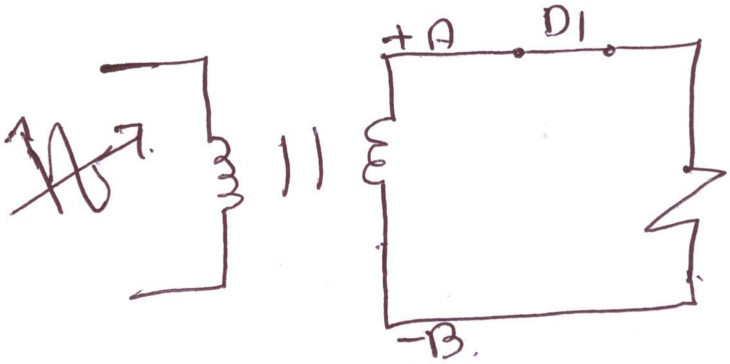
A
D1
RL
B



Esm
wt.
0
π
2π
3π
4π
Vout put
wt.
0
π
2π
3π
4π
IL load current
wt
0
π
2π
3π
4π

In half wave rectifier only one diode is presen

during forward bias the node A is positive and node B is negative hence diode acts as a closed switch so the f current will be flow.



During Reverse bias the node B is positive an node A is negative hence diode acts as a open switch so there is no flow of current.