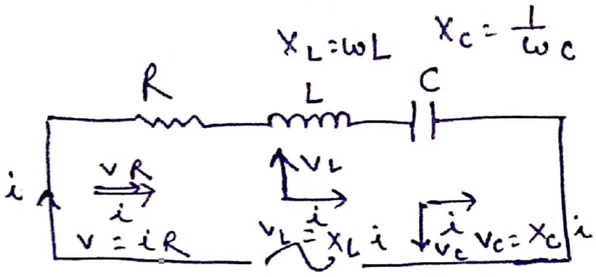
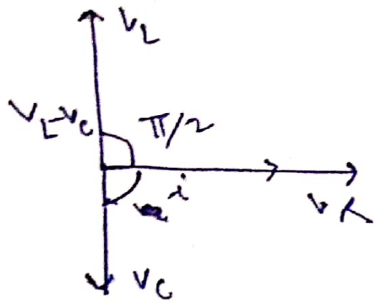
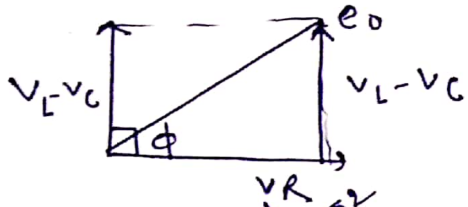
LCR Series Circuit :—

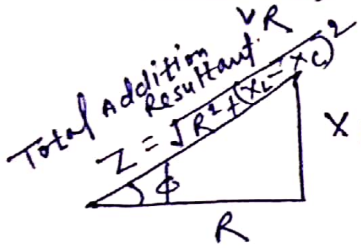


$$V_R + V_L + V_c = e_0$$

$e = e_0 \sin \omega t$







$$Z = \sqrt{R^2 + (X_L - X_c)^2}$$

$$\boxed{e_0 / i_0 = Z}$$

Unit of Z = ohm.

$$i = i_0 \sin(\omega t + \phi)$$

$$\cos\phi = R/Z$$

$$\cos\phi = R / \sqrt{R^2 + (X_L - X_c)^2}$$

Variation in impedance Z — Z will change the frequency of input supply change.

$$Z = \sqrt{R^2 + \left(\omega L - \frac{1}{\omega C}\right)^2}$$

Z impedance will be minimum when

$$\omega L - \frac{1}{\omega C} = 0 \quad \{X_L - X_c\} = 0.$$

when

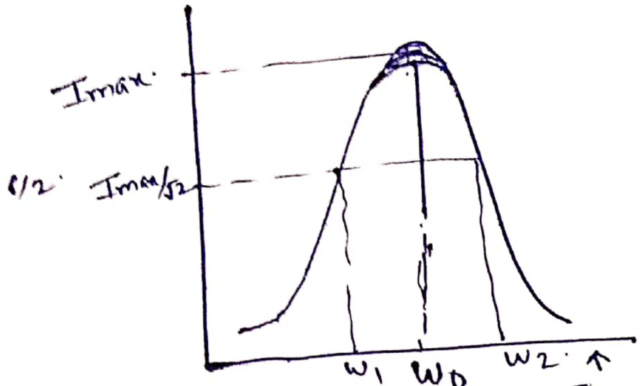
$$\omega L - \frac{1}{\omega C} = 0.$$

$$\omega L = 1/\omega C$$

$$\omega = 1/\sqrt{LC}$$

$$\boxed{Z_{min.} = R}$$

ω is natural frequency when Z is minimum. and current will be maximum.



$$\omega_0 = 1/\sqrt{LC}$$ Resonance.

For series circuit.

$e = e_0 \sin \omega t.$

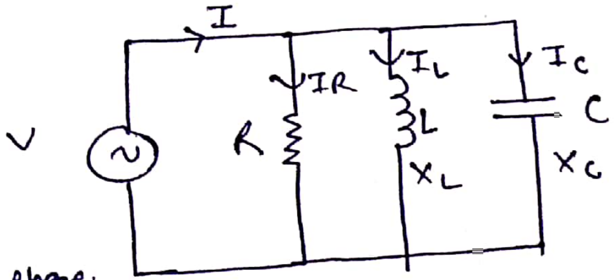
*Band width → Band width represent the range of frequency for where the power level in the signal attend half the max. power.

$$B.W. = \omega_2 - \omega_1.$$

* Quality factor → shows the sharpness of resonance curve.

$$\boxed{Q = f_0 / B_w}$$

* Parallel Resonance Circuit :→



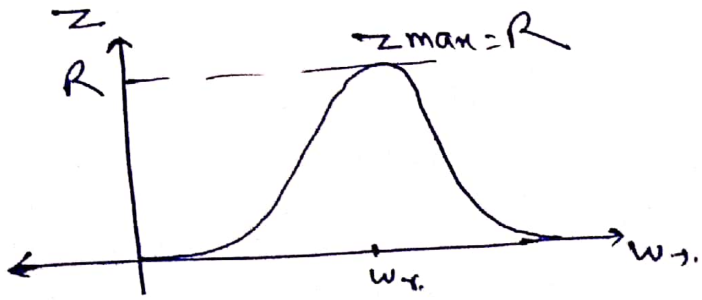
For resonance Condition,

$X_L = X_C$

Voltage and current are in phase.

impedance is maximum.

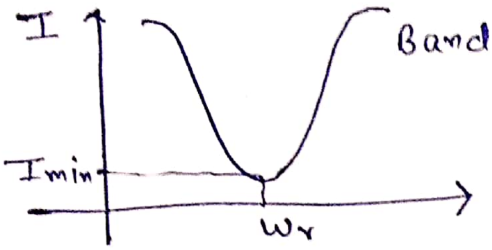
Current is minimum.



$\omega = 0 \Rightarrow X_L = 0.$

$\omega = \infty \rightarrow X_C = \frac{1}{\omega C} = 0$

Current versus frequency curve :-



for math. Expression.

$I_{rms} = I.$

$I = I_R + I_L + I_C.$

$= \frac{V}{R} + \frac{V}{X_L} + \frac{V}{X_C}$

$= V\left[\frac{1}{R} + \frac{1}{J\omega L} + J\omega C\right]$

$= V\left[\frac{1}{R} + J\left(\omega C - \frac{1}{\omega L}\right)\right]$

Admittance. Y.

$I = V.Y_{min}$

$\omega L = \frac{1}{\omega C} \Rightarrow Y = \frac{1}{R}$ → Resonance Condition.

$I = V/R$

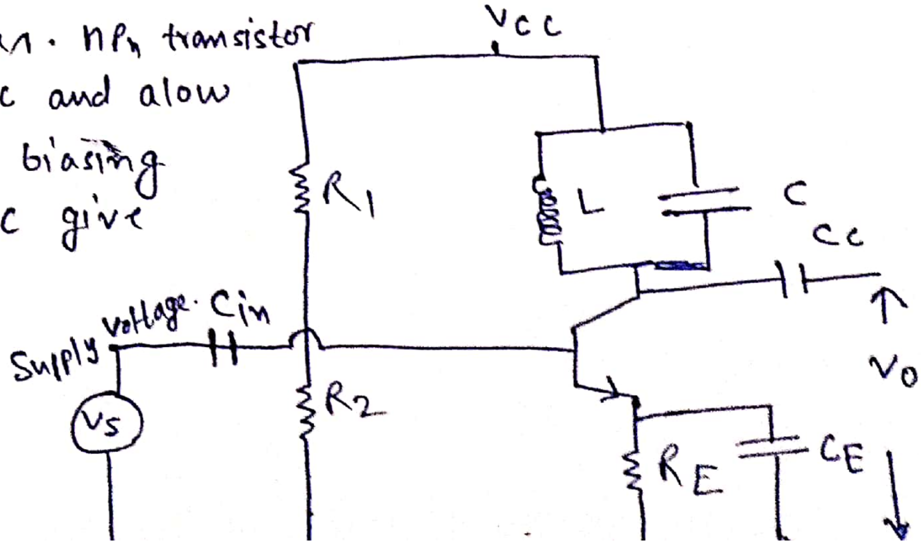
$\Rightarrow$ $Z = R_{maximum}.$

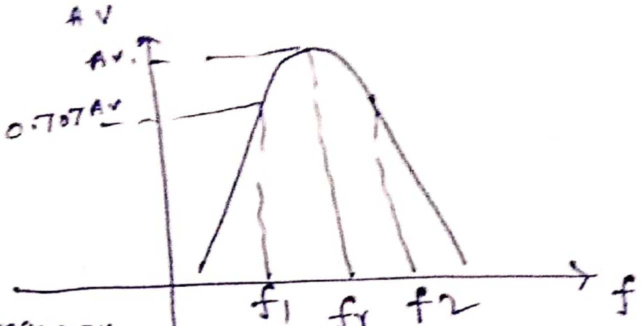
$\omega^2 = 1/LC$

$\omega = 1/\sqrt{LC}$ rad/sec.

* Single Tuned amplifier :- Single Tuned amplifier are used to amplify a particular frequency at Collector side instead of Load tuned Circuit or tank Circuit LC Circuit is used

The diagram is an npn transistor is used Cin block dc and alow ac R_1 and R_2 are biasing resistor and L and C give tank circuit.





frequency Response.

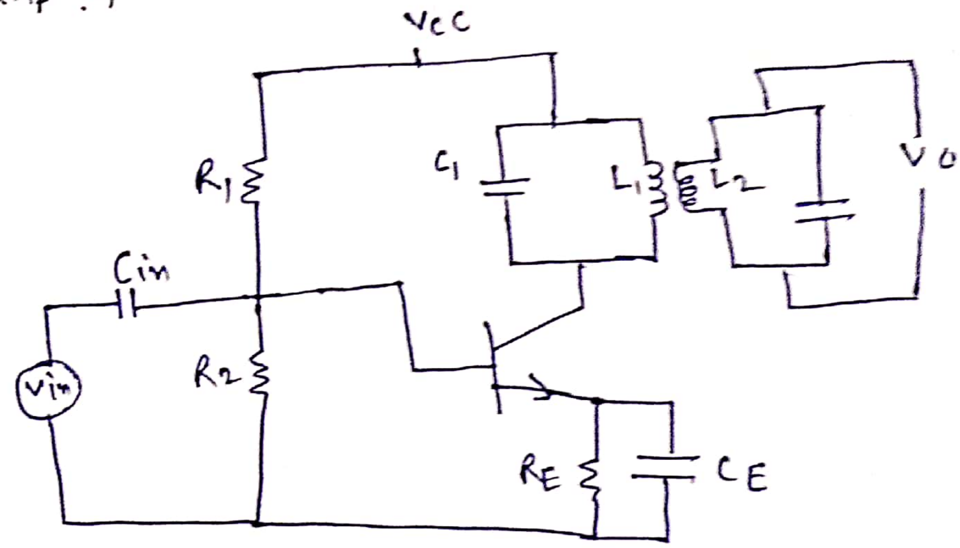
for LC Circuit the frequency.
for turning $X_L = X_C$

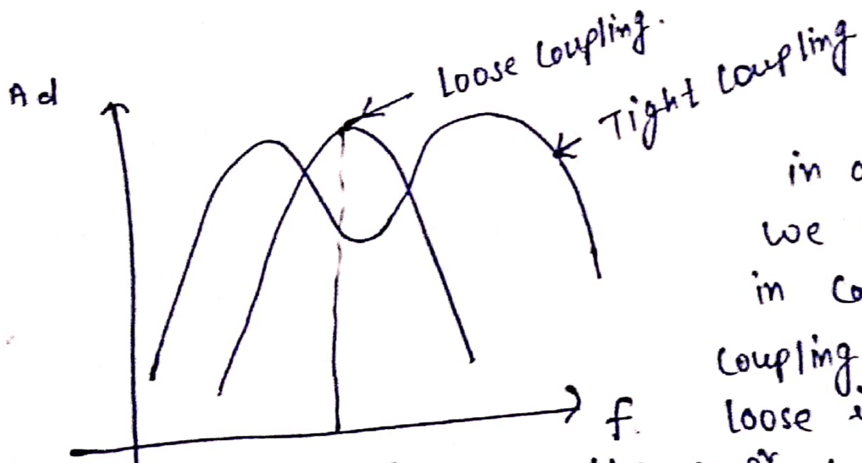
$$\omega L = \frac{1}{\omega C}$$

$$\omega_r = \frac{1}{\sqrt{LC}} \text{ rad/sec.}$$

This frequency is called resonance frequency which is tuned to source frequency.

* Double tuned ampr :-





in double tuned amplifier we use Two LC Circuit in Collector load. if the coupling between L_1 and L_2 is loose it mean's the L_1 and L_2 are far away the ampr. work as single tuned ampr. but if tight couple the band width will increase

* Wave shaping Circuits :-> To change the shape of the waveform is called wave shaping Circuits. like Clipper's and Clamper's.

* Clippers – we use diode along with resistors and capacitor's to shape waveform.

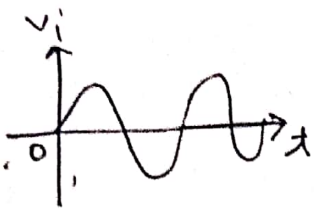
* If we want to clip portion of the waveform we use clippers for this purpose and if we want to shift or clamp the dc voltage level we use clampers.

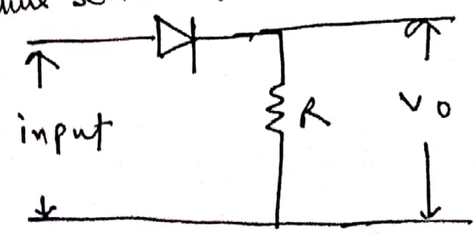
Clippers : Clippers are networks that use diodes to clip a portion of input signal without distorting the remaining part of waveform.

clippers.
- Series
  - Unbiased series (Basic).
    - +ve clipper
    - -ve
  - Biased series.
    - +ve
    - -ve
- Parallel.
  - Unbiased (Basic) Parallel.
    - +ve
    - -ve
  - Biased Parallel
    - +ve
    - -ve

Clamper :-> A clamper is a network constructed of a diode a resistor, and a capacitor that shifts the waveform to a different dc level without changing the appearance of the applield signal.

* Unbiased Series Clipper : ① Negative series Clipper :-





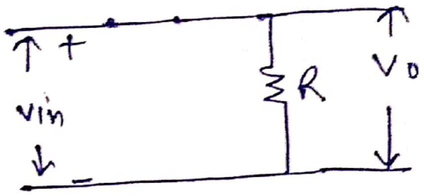
it is also half wave rectifier.

Case ① if $V_i > 0$

Diode D is in forward bias and act as short circuit.

if nothing mention it is ideal diode.

$V_0 = V_{in}$

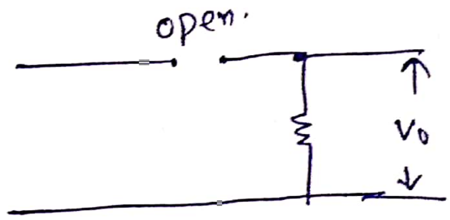


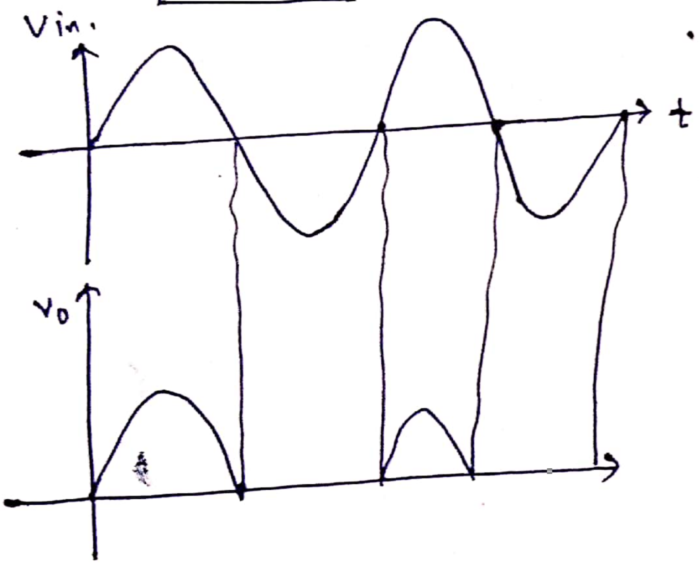
Case (II) if $V_{in} < 0$

Diode is reverse bias.

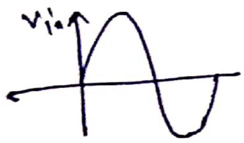
act as open circuit.

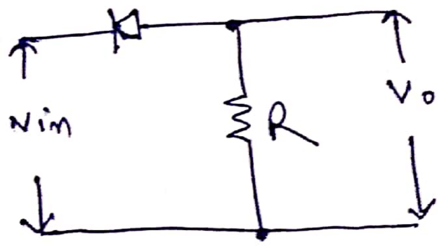
$V_0 = 0$





(II) Positive series clipper :-



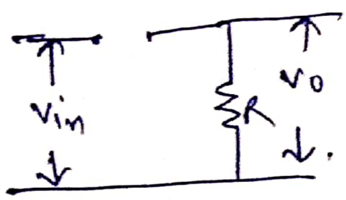


Case (I). if $V_i > 0$

Diode is open circuit.

R.B.

$V_0 = 0$

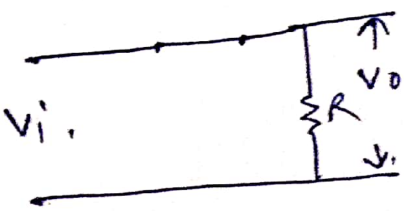


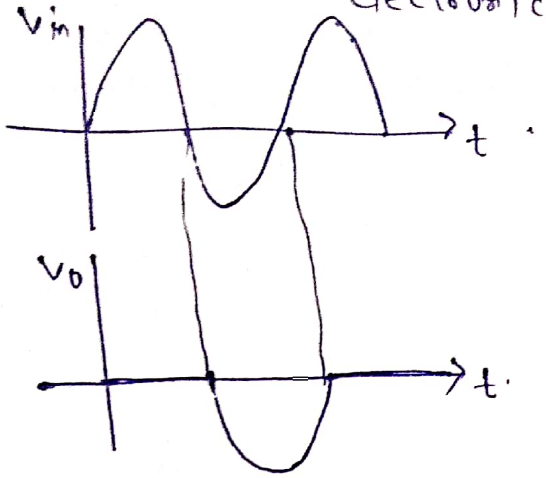
case (II) if $V_i < 0$.

Diode is in F.B.

act as short circuit.

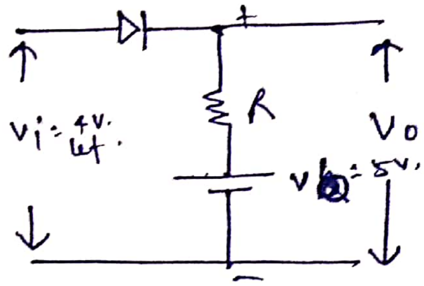
$V_0 = V_{in}$

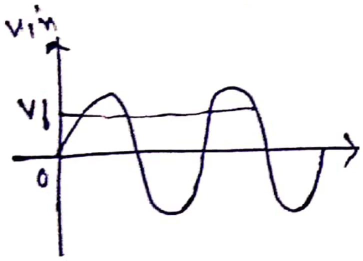




* Biased Series clipper :-

(1) Biased Negative Series clipper :-



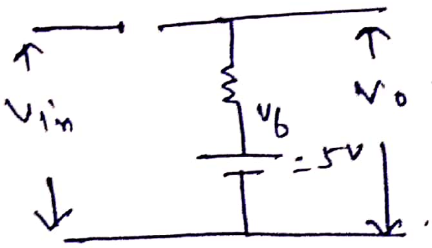


let $V_b = 5$ v.
$V_{in} = 4$ v.

Case (1) $V_{in} < V_b$

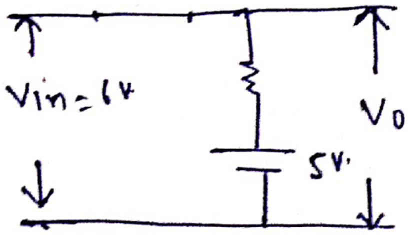
Diode is reverse biased.
and open circuit.

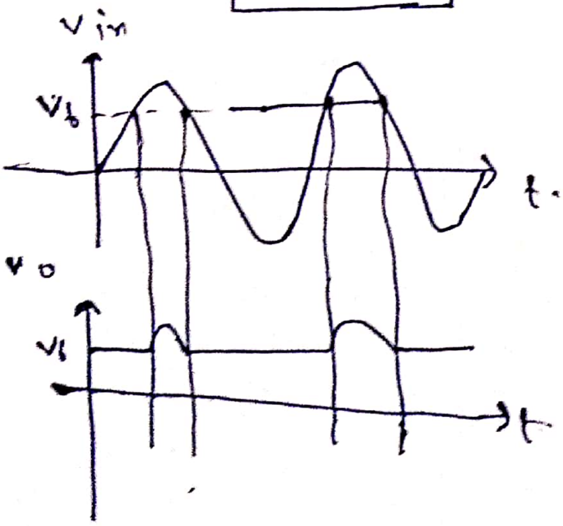
$V_o = 5V = V_b$



Case (ii) $V_i > V_b$. Diode D in forward bias
work as short circuit.

$V_o = V_{in}$

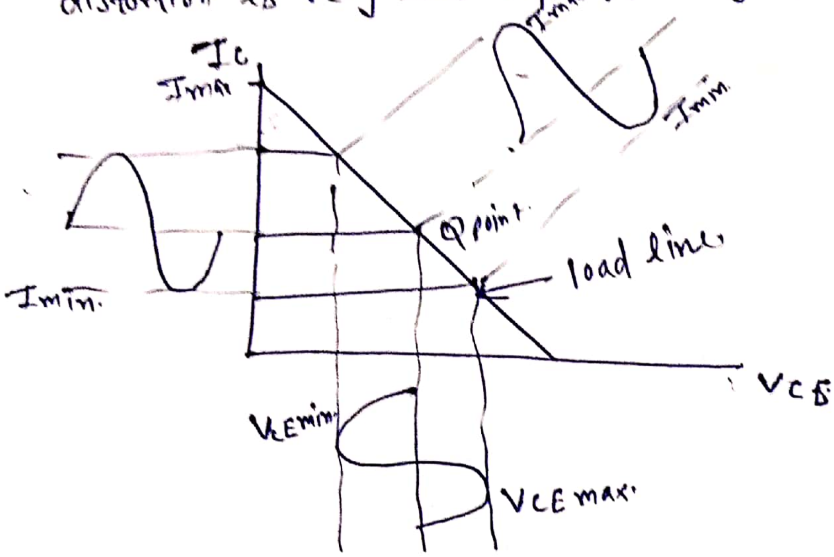




* Classification of Power ampr :→ Power amplifiers are classified according to the position of the quiescent point on the load line.

Type → 1 - Class A
2 - Class B
3 - Class C
4 - Class AB.

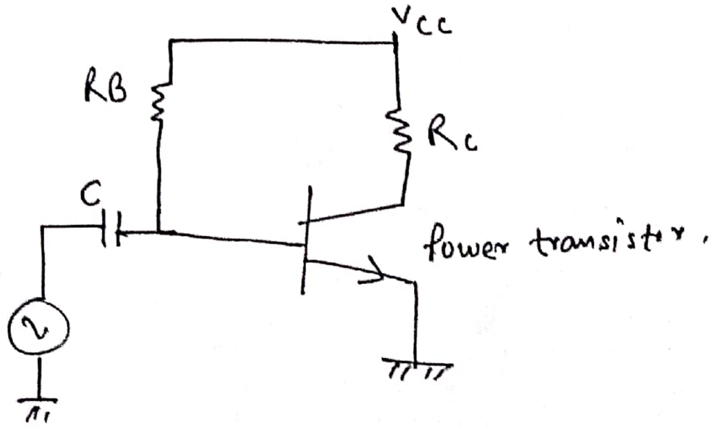
a. Class A → In this amplifier the collector current flow at all the time during full cycle of i/p signal.
The quiscent point present in the middle of the load line.
distortion is very low but efficiency is also very small.



Adv. → (I) Least distortion.

disadv. → (I) Low power o/p.
(II) small efficiency

* Maximum Collector efficiency 'η' of series fed Class A power ampr :→.



This circuit is rarely used in power amplification due to it's poor collector efficiency.

Expression for collector efficiency 'η'.

$$\eta = \frac{\text{ac power output}}{\text{dc. power input}}$$

$$\eta = P_o / P_{dc}$$

$P_{dc} = V_{cc} I_c$ [V_{cc} → collector supply. I_c → average collector current]

$P_o = V_{ce} I_c$ → r.m.s value of output signal current

r.m.s. value of signal output voltage.

$V_{ce(P-P)}$ r.m.s. value of voltage – $\frac{V_{ce}/2}{\sqrt{2}}$.

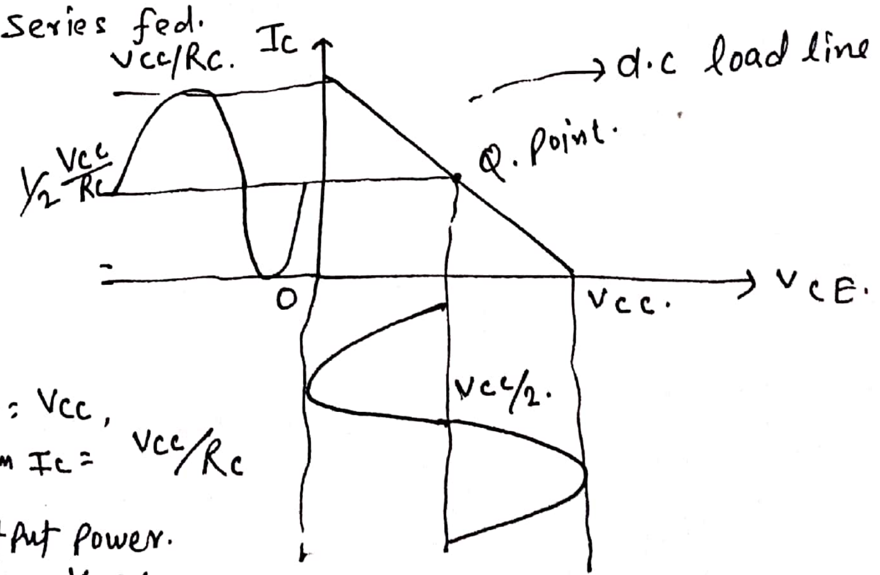
$V_{ce} = V_{ce}/2\sqrt{2}$.

Similarly: $I_c = \frac{I_{c(P-P)}}{2\sqrt{2}}$.

Collector efficiency 'η' $= \frac{(V_{ce} \times i_c)(P-P)}{2\sqrt{2} \times 2\sqrt{2} \times V_{cc} I_c}$.

$$\eta = \frac{V_{ce} \times i_c}{8 V_{cc} I_c}$$

for series fed.



maximum $V_{ce} = V_{cc}$,
maximum $I_c = V_{cc}/R_c$

maximum ac. output power.

$$P_o = \frac{V_{cc} \times V_{cc}/R_c}{8} = V_{cc}^2 / 8R_c.$$

$P_{dc} = V_{cc} \times I_c$ ← dc current of signal $= V_{cc} \times V_{cc}/2R_c$

maximum collector $\eta = \frac{V_{CC}^2/8R_C}{V_{CC}^2/2R_C}$

$= 25\%$.

in actual the 'η' is far less than this value.

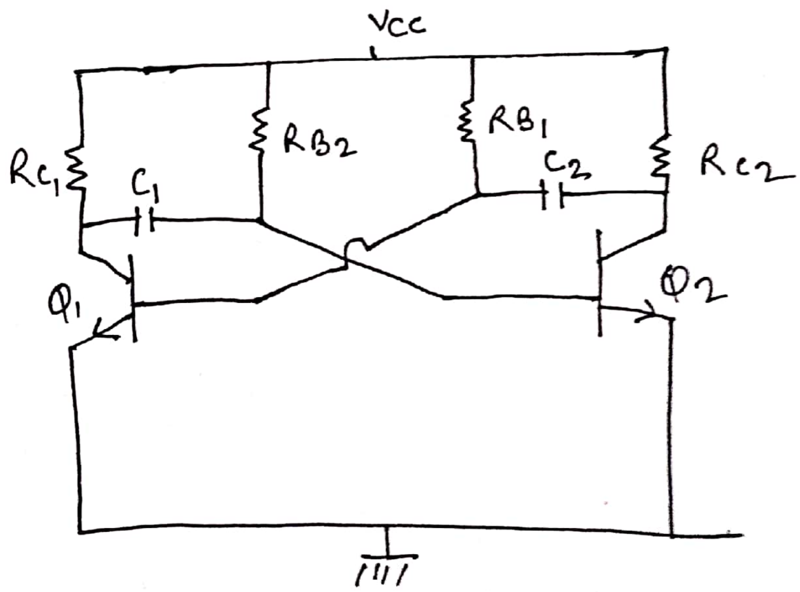
* For Trans-former Coupled Class A power amplifier efficiency is 50%.

* Multivibrator :— Multivibrator is the electronic Circuit which is used to implement two state devices like oscillator, timer and Flip-Flop.

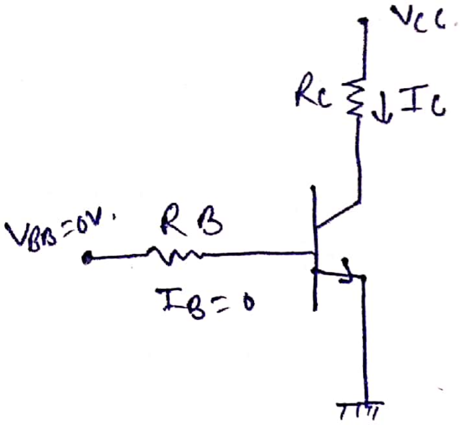
multivibrator can be devided into three types.

(I) Astable multivibrator — No stable state.
(II) mono stable multi vibrator. — quasi stable state.
(III) Bistable " — Two stable state.

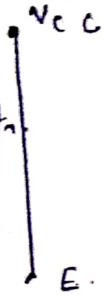
* working of Astable multivibrator using BJT :—



Before that we should under stand how transistor work as a switch. as we know for transistor three region. Active, Cut-off and saturation, In active region it work as amplifier, in saturation and cut-off it work as a switch.



for voltage VBB is less than 0.7 V. it work as open Circuit hence, it is cut-off region. Vce = Vcc



for VBB > 0.7V,
it work as short circuit
the VCE = 0. or it work
in Saturation region.

in this way.
so transistor work as a switch.

Now in Astable multivibrator diagram. both the transistor are off. as transistor given the supply both try to on but due to transistor mismatch one transistor is on and other is off. let's Q_1 is on and it go on saturation and Q_2 in cut-off and than Q_2 in saturation and Q_1 in cut-off so their is no stable state in Astable multivibrator