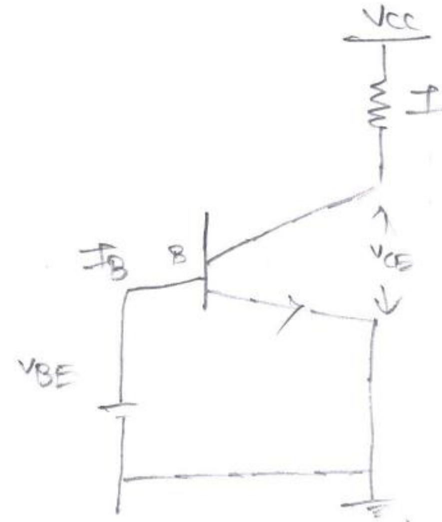
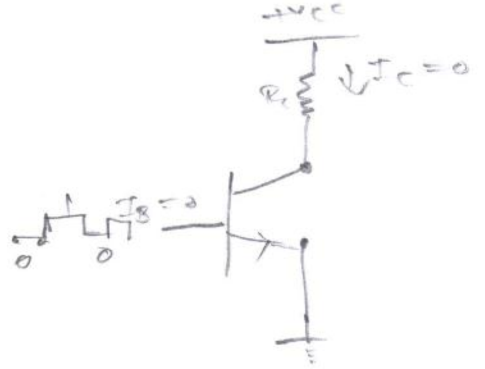
IAT-3

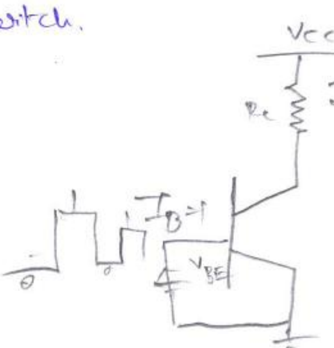
1) The operation of BJT as an switch:-



* In this we are giving the square feet signal
* when we are giving the $I_B=0$ then the output Current is also $I_C=0$ then it acts as open switch.



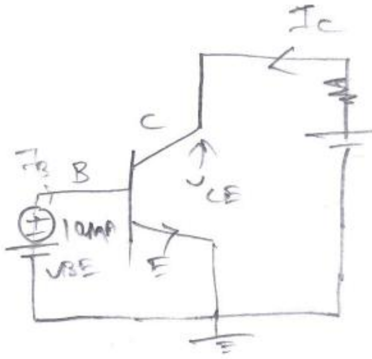
* In this when we are given the I_B is some of the value that means $I_B=1$ then the output Current is also is there then it acts as Closed Switch.



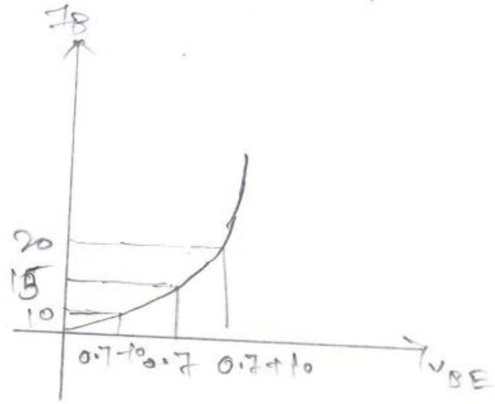
$V_{CC} = I_C R_C + V_{BE}$

$$\boxed{I_C = \frac{V_{CC} - V_{BE}}{R_C}}$$

BJT as an amplifier:-



Consider and npn transistor and that will be given BE is in forward bias and CB is connected in Reverse bias and we are given β has 100 mA.



construct a graph that will be $I_B(V_s)$ V E from this graph

At 0.7 -10, $V_B = 10\,\mu A$

At 0.7+10, $V_B = 20\,\mu A$

$$\Delta V_B = 20 - 10\,\mu A = 10\,\mu A$$

By graph, $\Delta V_c = (0.7+10) - (0.7-10)$

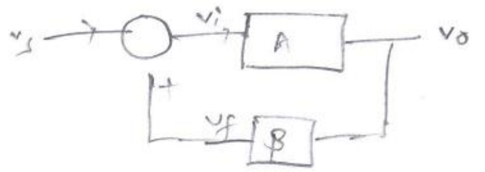
$$= 20\,mA$$

W.K.T $\Delta V = \dfrac{\Delta V_B}{\Delta V_c} = \dfrac{10\,\mu A}{20\,mA} = 50$

Now we can say that it is amplified.

CMR

27 Barkhausen's criteria:-



$$\beta = \frac{-v_f}{V_o} \Rightarrow v_f = -\beta v_o \rightarrow (1)$$

$$A = \frac{V_o}{V_i} \Rightarrow V_o = A v_i \rightarrow (2)$$

$$V_i = v_f \quad (\text{there source. } V_s \text{ is zero})$$

Substituting (2) in (1)

$$V_f = -\beta(A v_i)$$

$$V_f = -A\beta v_f$$

$$A\beta = -1 \qquad \text{-ve sign indicates phase shift}$$

$$|A\beta| = 1$$

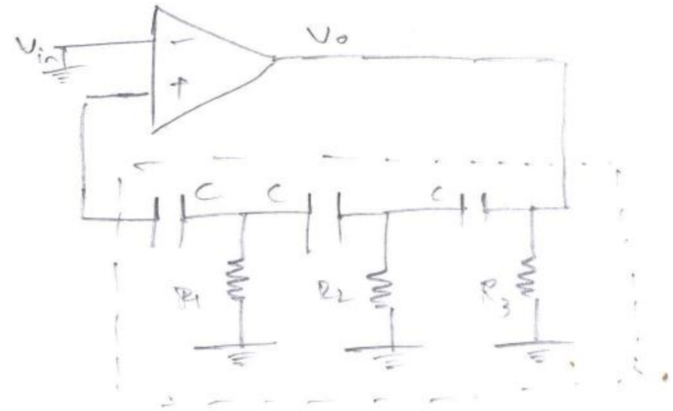
Criteria 1:-

Magnitude is product of the amplifier A and β feed back factor is unity.

Criteria 2:-

If it is connected to the input signal with the feedback factor there will be phase of 0° (or) 360°

Operation of Rc phase :-



$$f = \frac{1}{2\pi\sqrt{6}\,Rc}$$

Here 1 capacitor Rc indicates 60° phase shift

2 Rc indicates 180° phase shift

3 Rc indicates the 0° (or) 360° phase shift

(by criteria 2).

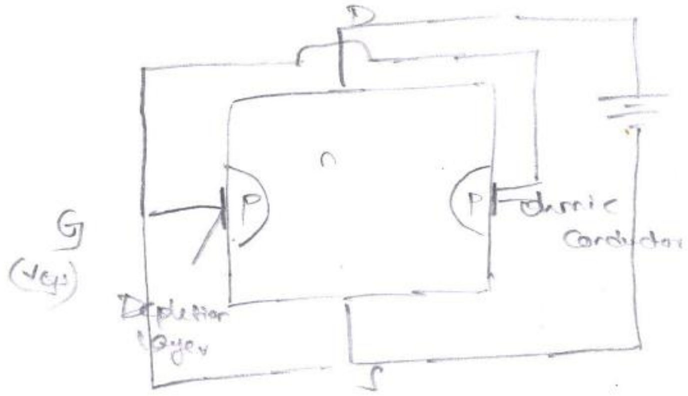
3)

FET:-

It has 3 parts Gate, Drain, Source

It is Similar to the Transistor.

Construction of n-channel JFET:-



In this n-channel JFEC it has two cases

i) $V_{GS} = 0$

ii) $V_{GS} < 0$

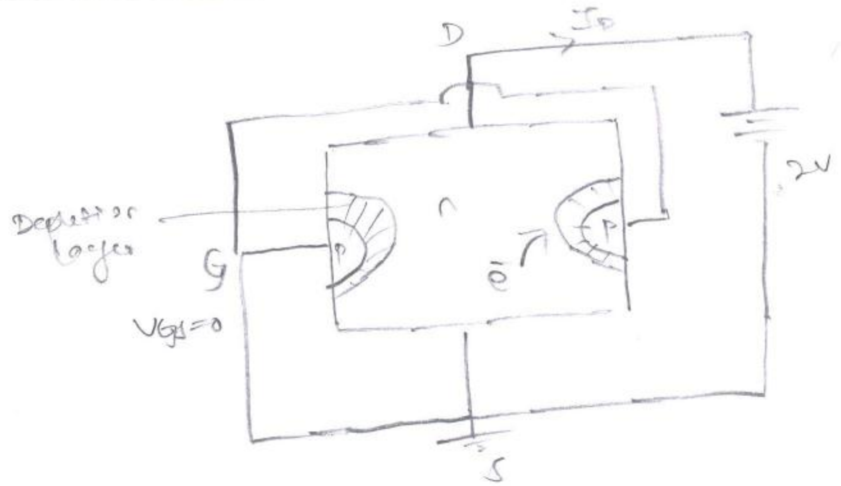
Here $V_{DS} > 0$ (positive)

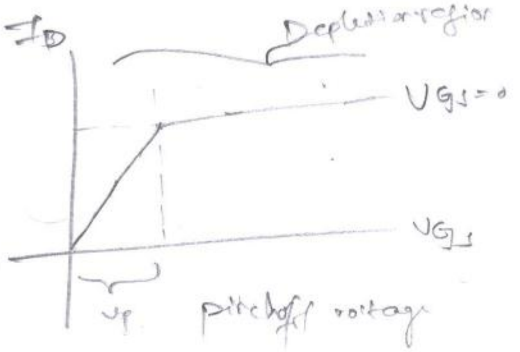
Here In this n-channel JFET we taking pnp one side depletion layer and other is connected to ohmic conductor and G is connected to the ohmic and source also connected to the Gate and Drain connected to the source to get V_{DS}

Working:-

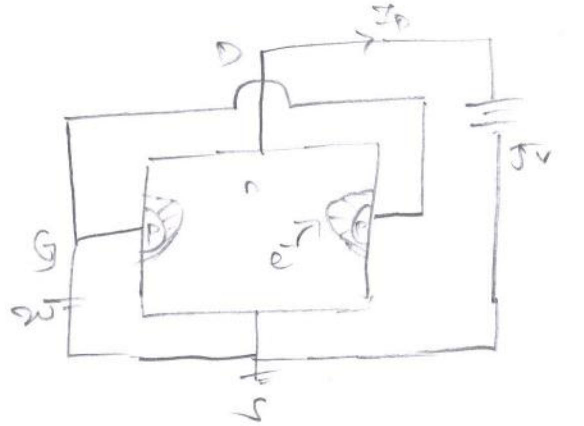
Case i:-

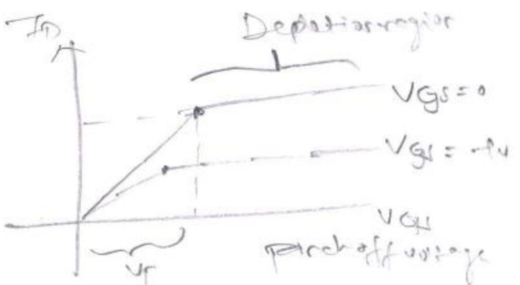
$V_{GS} = 0$, $V_{DS} > 0$



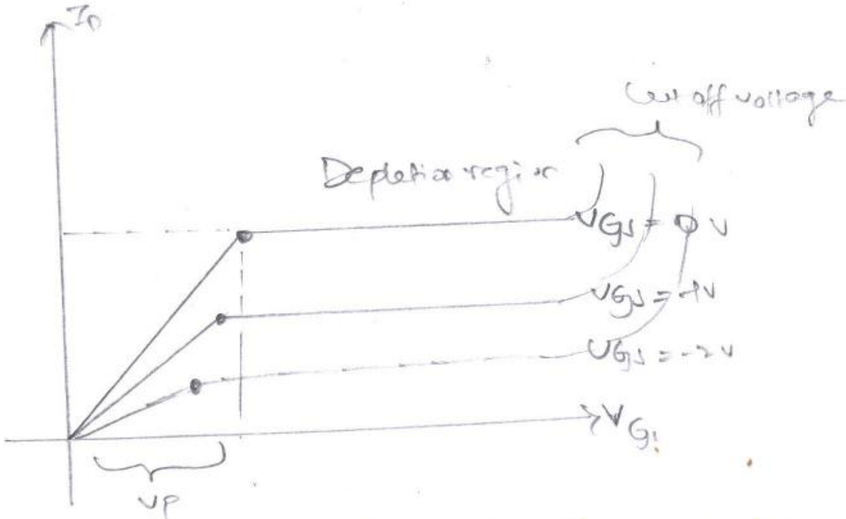


Case ii:- $V_{GS} < 0$, $V_{DS} > 0$





Drain characteristics:-

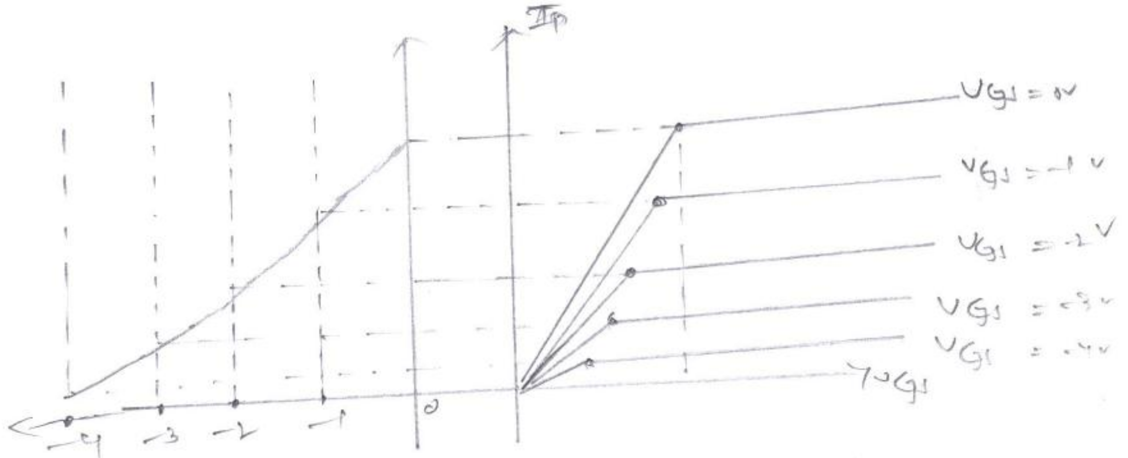


By taking the graph of I_D and V_{GS}

$$I_D = I_{DSS}\left[1 - \frac{V_{GS}}{V_P}\right]^2$$

This is the Drain characteristic formula.

Transfer characteristics:-



7) a) A Certain JFET has of $-2nA = I_{GSS}$

$V_{GS} = -20V$

By ohms law

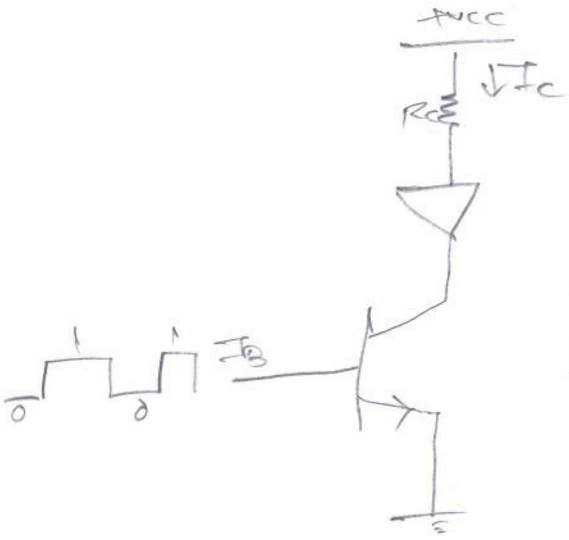
$V = IR$

$R = \frac{-20V}{-2nA}$

$= \frac{+20}{+2 \times 10^{-9}}$

$\boxed{R = 10^{10} \Omega}$

b) transistor switch circuit to turn on/off an LED:-



In this ... taking the Square feet signal.

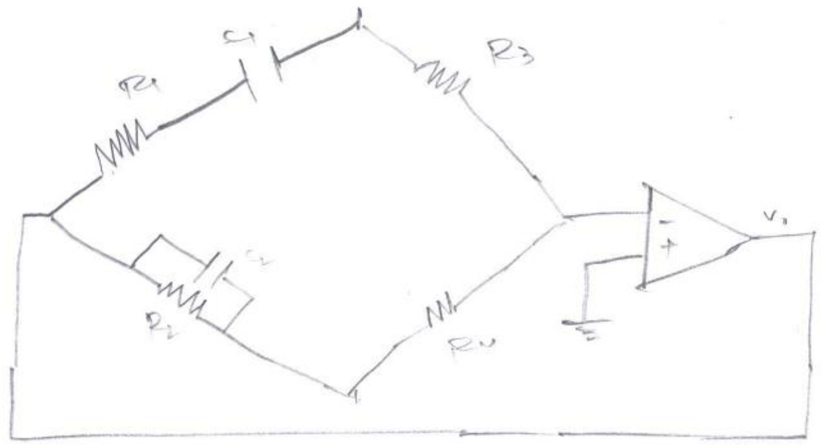
* when we are giving $I_B = 0$ and there is no I_C. $I_C = 0$ and it acts as open switch the LED will be off.
* when we are giving $I_B = 1$ and there is I_C. $I_C = \frac{V_{CC} - V}{R_C}$ and it acts as closed switch the LED will be on for ~~1sec~~ and it will off

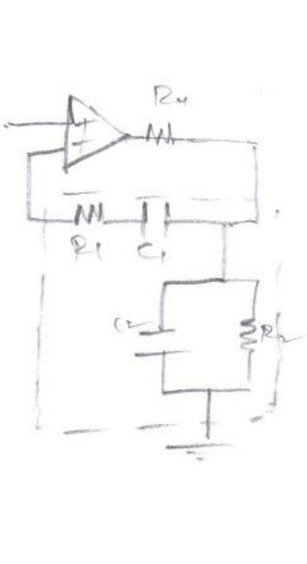
6) oscillators:-

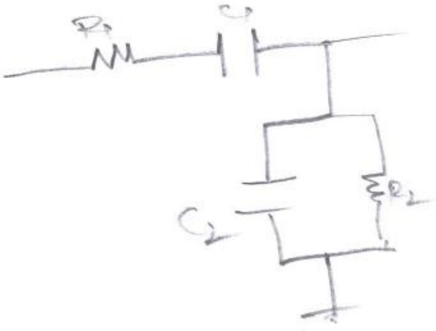
Oscillators is works on the positive feed back. and In this there is no input voltage is given to the circuit. the voltage already present in that acts as noise.

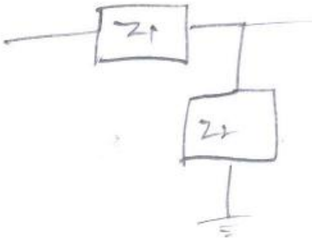
$$\boxed{\text{for oscillator is } \frac{A}{1-A\beta}}$$

b) weir bridge oscillator:-









$$Z_1 = R_1 + \frac{1}{j\omega C_1}$$

$$\frac{1}{Z_2} = \frac{1}{R_2} + \frac{1}{1/j\omega C_2}$$

$$= \frac{1}{R_2} + \frac{j\omega C_2}{1}$$

$$\frac{1}{Z_2} = \frac{1 + j\omega C_2 R_2}{R_2} \Rightarrow Z_2 = \frac{R_2}{1 + j\omega C_2 R_2}$$

$$V_0 = \frac{Z_2 \, v_{in}}{Z_1 + Z_2}$$

$$\frac{V_0}{v_{in}} = \frac{Z_2}{Z_1 + Z_2}$$

$$= \frac{\dfrac{R_2}{1 + j\omega C_2 R_2}}{R_1 + \dfrac{1}{j\omega C_1} + \dfrac{R_2}{1 + j\omega C_2 R_2}}$$

$$= \frac{\dfrac{R_2}{1 + j\omega C_2 R_2}}{\dfrac{R_1 j\omega C_1 + 1}{j\omega C_1} + \dfrac{R_2}{1 + j\omega C_2 R_2}}$$

$$= \frac{\dfrac{R_2}{1+j\omega C_2 R_2}}{\dfrac{(1+j\omega C_2 R_2)(1+j\omega R_1 C_1)+R_2(j\omega C_1)}{j\omega C_1(1+j\omega C_2 R_2)}}$$

$$= \frac{R_2(j\omega C_1)(1+j\omega C_2 R_2)}{R_2(j\omega C_1) + (1+j\omega C_2 R_2)(1+j\omega R_1 C_1)}$$

$$= \frac{j\omega C_1 R_2}{\omega^2 R_1 C_1 R_2 C_2 + 1 + j\omega(R_1^2 C_1^2 R_2 C_2)}$$

By taking Real part is zero

$$\omega^2 R_1 C_1 R_2 C_2 - 1 = 0$$

$$\omega^2 R_1 C_1 R_2 C_2 = 1$$

$$\omega^2 = \frac{1}{R_1 C_1 R_2 C_2}$$

$$\omega = \frac{1}{\sqrt{R_1 C_1 R_2 C_2}}$$

$$2\pi f = \frac{1}{\sqrt{R_1 C_1 R_2 C_2}}$$

$$f = \frac{1}{2\pi\sqrt{R_1 C_1 R_2 C_2}}$$

if $R_1 = R_2 = R$

$C_1 = C_2 = C$

$$f = \frac{1}{2\pi RC}$$