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ABDUL MOEZ

Electronics 1

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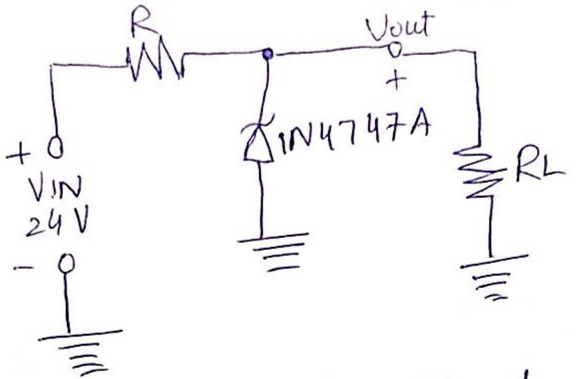
Q^1



Sol: from the data sheet we can write of 1N4747A

$V_Z = 20V$

$I_Z = 12.5mA$; $Z_Z = 22$.

$I_{ZK} = 0.25mA$

a) $V_{out} = ?$ at I_{ZK} & I_{ZM}

first to find $V_{out(IZK)}$ & then I_{ZM}.

$V_{out} = V_Z - \Delta V_Z$ (for I_{ZK})

$= V_Z - (I_Z - I_{ZK}) Z_Z$

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$V_{out} = V_Z - (I_Z - I_{ZK}) Z_Z$

$V_{out} = 20 - (12.5 - 0.25) 22$

$V_{out} = 20 - (12.25) 22$

$V_{out} = 20 - 0.2495$

$\boxed{V_{out} = 19.7305V}$ for I_{ZK}.

Now Vout for I_{ZM} first to find I_{ZM}:

$$I_{ZM} = \frac{P_{D(MAX)}}{V_Z}$$

for zener max current the maximum power dissipated is 1W

$$I_{ZM} = \frac{P_{D(Max)}}{V_Z} = \frac{1W}{20V} = 0.05A$$

$$\boxed{I_{ZM} = 50mA}$$

Now Vout for I_{ZM}

$V_{out} = V_Z + \Delta V_Z$

$V_{out} = V_Z + (I_{ZM} - I_Z) Z_Z$

$V_{out} = 20 + (50mA - 12.5mA) 22\Omega$

$V_{out} = 20 + (37.5mA) 22\Omega$

$\boxed{V_{out} = 20.825V}$ for I_{ZM}

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(B) $R = ?$

As we know

$$V_{IN(max)} = I_{ZM} R + V_{out}$$

$$R = \frac{V_{IN} - V_{out}}{I_{ZM}} = \frac{24V - 20.825V}{50mA}$$

$$\boxed{R = 63.5\Omega}$$

c) Minimum load resistance $R_L = ?$

To find min load resistance we will Consider maximum load Current

So $$I_T = \frac{V_{in} - V_Z}{R} = \frac{24 - 20}{63.5\Omega} = \frac{4}{63.5} = 62.99$$

$$\boxed{I_T = 63mA}$$

Now to find $I_{L(Max)}$:

$$I_{L(max)} = I_T - I_{ZK}$$

$$= 63mA - 0.25mA$$

$$I_{L(max)} = 62.75mA$$

So $R_L(min) = \frac{V_Z}{I_L(max)}$

$= \frac{20}{62.75\,mA}$

$$R_L(min) = 318.72\,\Omega$$

It's the required minimum Value of R_L.

Answered.

Q4 For a transistor to act as a Switch you need to join each of the following Conditions on the left to ON or OFF state

Transistor fully ON (ON)

Transistor fully OFF (OFF)

Input & base are at 0V (OFF)

Collector Current $I_c = 0$ (OFF)

$V_{CE} = V_{CC}$ (OFF)

BE Junction is reverse bias (OFF)

BC Junction is ~~forward~~ reverse bias (OFF)

Max of Saturation Current I_c flows (ON)

BE Junction is forward bias (ON)

BC Junction is forward bias (ON)

$V_{CE} = 0V$ (ON)

BE Junction is less than 0.7V (OFF)

Answered

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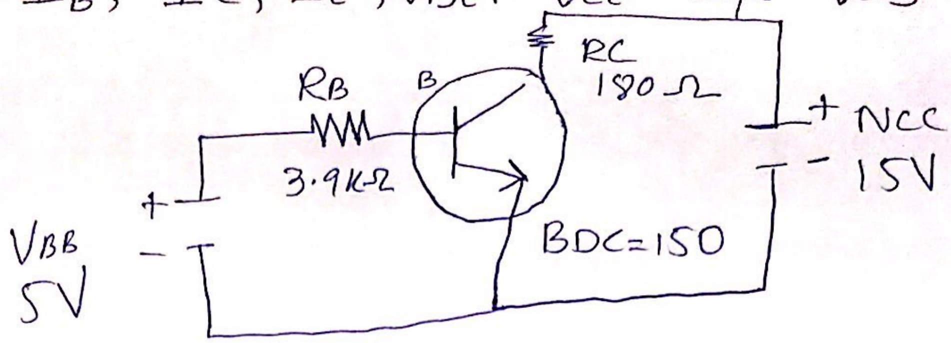
Q2 I_B, I_C, I_E, V_{BE}, V_{CE} & V_{CB}



Sol: From the given figure we can write

$V_{BB} = 5V$, $R_B = 3.9K\Omega$, $R_C = 180\Omega$, $V_{CC} = 150$

As I_B is given by $\beta_{DC} = 150$

$$I_B = \frac{V_{BB} - V_{BE}}{R_B} = \frac{5V - 0.7V}{3.9K\Omega} = \boxed{1102\mu A}$$

& we know

$$I_C = \beta_{DC} I_B = (150)(1102\mu A)$$

$$\boxed{I_C = 165.3mA}$$

$$I_E = I_C + I_B = 165.3mA + 1102\mu A = 166.4mA$$

$$\boxed{I_E = 166.4mA}$$

Now to find V_{CE} first

$$V_{CE} = V_{CC} - I_C R_C = 15V (165.3mA)(180\Omega)$$

$$= 15V - 29.7V = \boxed{-14.7V}$$

Now

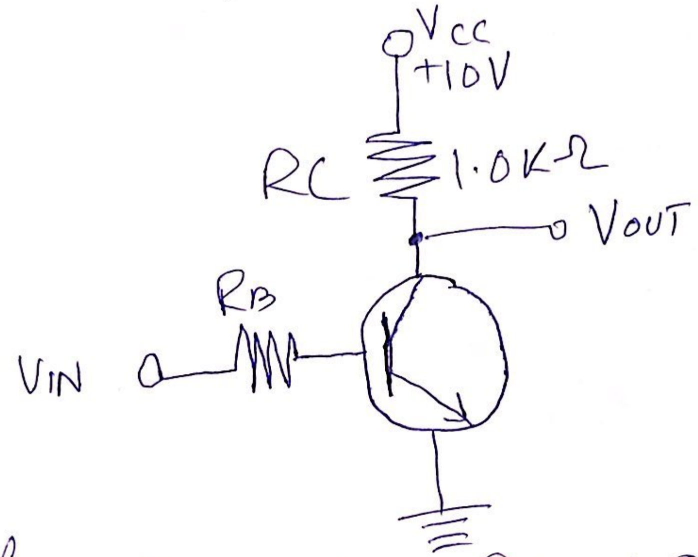
$$V_{CB} = V_{CE} - V_{BE} = -14.7V - 0.7V = \boxed{-15.4V}$$

Since collector is at a lower voltage than the base, the collector base junction is forward biased.

Q6 For the transistor Circuit Calculate the following

a) What is V_{CE} when $V_{IN} = 0V$?

b) Determine the minimum Value of I_B is required to Saturate this transistor if β_{DC} is 125 & $V_{CE(sat)}$ is 0.4V.



Sol:-

From figure $V_{CC} = 10V$; $RC = 1.0K\Omega$

a) $V_{CE} = ?$ when $V_{in} = 0V$

As we know that for $V_{in} = 0V$ the transistor will be in cutt off mode

& V_{CE} will be the same as V_{CC}

$\Rightarrow V_{CE} = V_{CC} = 10V$

So $\boxed{V_{CE} = 10V}$

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(B) $I_B = ?$ when $\beta_{DC} = 125$ & $V_{CE(sat)} = 0.4V$

we can find $I_{C(sat)}$ to calculate $I_{B(min)}$

$$I_{C(sat)} = \frac{V_{CC}}{R_C} = \frac{10V}{1.0k\Omega} = 10mA$$

So $$I_{B(min)} = \frac{I_{C(sat)}}{\beta_{DC}} = \frac{10mA}{125} = 0.08mA$$

$\boxed{I_{B(min)} = 0.08mA}$ is the required min I_B to saturate the transistor.

Answered

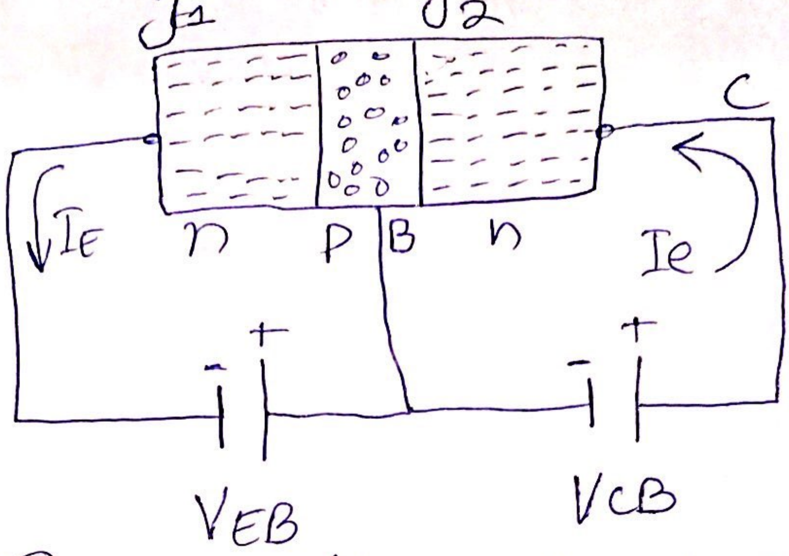
Q3 Discuss how is BJT used as an amplifier With the help of schematic diagram for a basic BJT amplifier? Which basic configurations are required for it? Consider input AC & DC Values as 5 μA & 15 μA respectively, assume $\beta = 200$.

Sol:
* BJTS can be used as amplifiers by using its "Active" Region of operation by acheiving forward biased mode of junction 1 (J1) & by reverse biasing the Junction 2 (J2)

S NO	J_1	J_2	Region of operation	Works as
1	F.B	R.B	Active	Amplifier
2	F.B	F.B	Saturation	ON Switch
3	R.B	R.B	Cutt off	OFF/open Circuit.
4	R.B	F.B	Inverted	rarely used

Above are the 4 modes the BJT can be used & mode 1 is the configuration of the BJT to be used as an amplifier.

Schematic Diagram.



Above Diagram shows the basic Configuration for Using a BJT in active region thus acting as an amplifier.

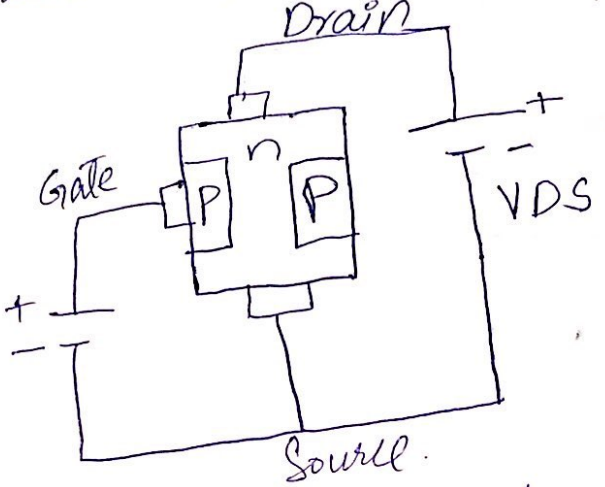
After application of V_{BE} the junction J_1 is F.B so the barrier potential will now reduce & new barrier potential will be $V_0 - V_{BE}$

☆ After Application of V_{CB} the J_2 in R.B so the B.P will increase & new B.P will be $V_0 + V_{CB}$.

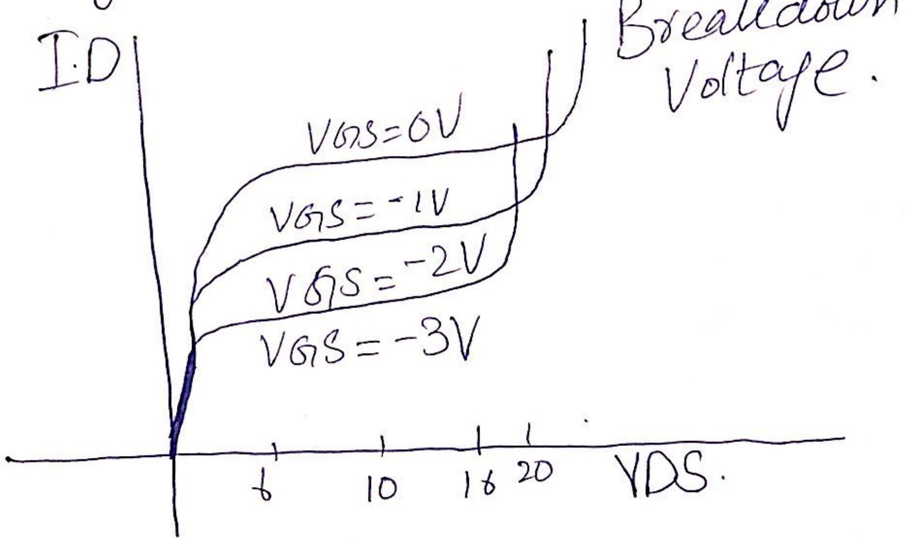
Because of reduces B.P at J_1 the e will move into P-region & recombine with hole at Base.

Q5 Discuss the JFET (n-channel) ------

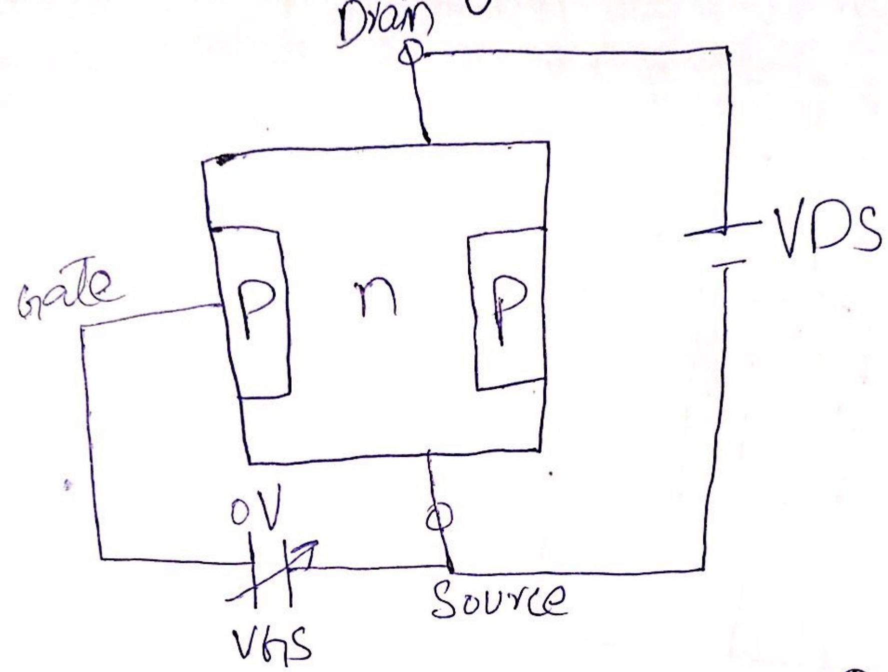
Sol. JFET is a type of junction field effect transistor which is voltage controlled device as differ from BJT which is current controlled.



Actually in FET the drain to source current is controlled by the width of the channel the electric field is produced by the gate to source. Voltage.



So if we see to the graph which the no Voltage applied to the gate the Current flows freely



The Channel are wider & Drain Current moves freely
if we move VGS to negative Value the Channel width Start to decrease a & Current Cannot moves.