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Module	Summer
Subject	Electronic Devices and Circuits
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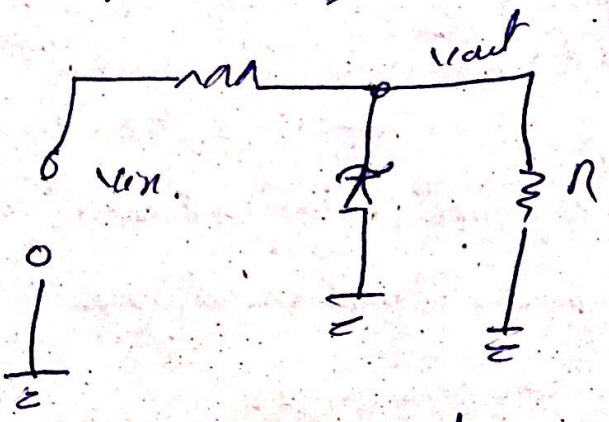
Q.No 1 :- From Data sheet.



from the Datasheet IN4744A.

$V_Z = 20 \quad I_Z = 12.5\,mA \quad \& \quad Z_Z = 22\,\Omega$

$I_{ZK} = 0.25\,mA$

(a) :- for I_{ZK} :-

$$V_{out} = V_Z - \Delta I_Z I_Z$$

$$= 20 - (I_Z - I_{ZK}) Z_Z$$

$$= 20 - (12.25)(22)$$

$$= 20 - (0.01225)(22)$$

$$= 20 - 0.2695$$

$$= 19.7305\,V$$

calculating zener max current the maximum power dissipation is

$$I_{ZM} = \frac{P_D(max)}{V_Z} = \frac{1W}{20} = 0.05\,A$$

$$I_{ZM} = 50\,mA.$$

for I_{zm}

$$V_{out} = V_z + \Delta I_z Z_z$$

$$= 20V + (I_{zm} - I_z) Z_z$$

$$= 20V + (80mA - 12.5mA)\,22\Omega$$

$$= 20V + (37.5mA)\,22$$

$$= 20V + 0.825$$

$$V_{out} = 20.825\,V$$

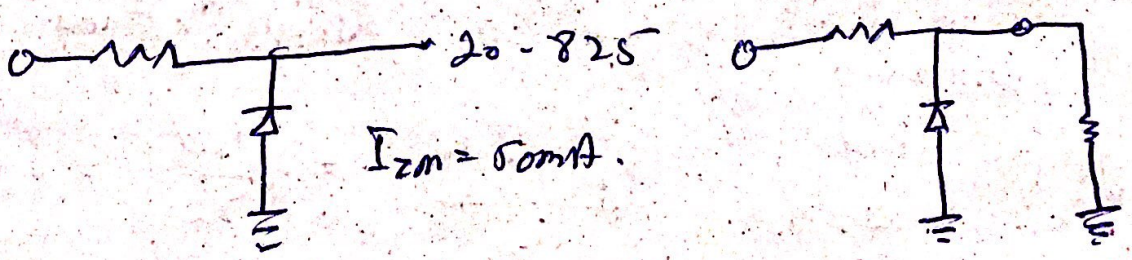
(b) calculate the value of R for maximum zener current when there is no load as show in figure.

$$R = \frac{V_{in} - V_{out}}{I_{zm}}$$

$$= \frac{24V - 20.825V}{80\,mA}$$

$$R = 63.5\,\Omega$$

$R = 70\,\Omega$ (Nearest biggest standard).



(c) for maximum load Resistance (maximum current) the zener diode current is minimum ($I_{ZK} = 0.25$)

$$I_T = V_{in} - V_{out}/R$$

$$= \frac{24V - 19.73V}{70\Omega}$$

$$= 0.061A$$

$$= 0.061A$$

$$I_T = 61\ mA$$

$$I_L = I_T - I_{ZK}$$

$$= 61 - 0.25\ mA.$$

$$I_L = 60.75\ mA.$$

$$R_L = V_{out}/I_L \quad \frac{19.3}{60.75} = \frac{19.3}{60.75}\ mA.$$

$$= 19.3/0.0671$$

$$= 285.925\Omega$$

$$\boxed{R_L = 286\Omega}$$

Q N/O 2 :- Detesmain I_B, I_C, I_E, V_{BE} ---.

Ans :- $V_{BE} = 0.7\ V$

$$\Rightarrow I_B = \frac{V_{BB} - V_{BE}}{R_B} = \frac{5V - 0.7V}{3.91k\Omega}$$

$$= 1102\ \mu A$$

$$\Rightarrow I_C = \beta_{DC} \cdot I_B = (150)(1102\ \mu A) = 165.3\ mA$$

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

Solve for V_{CE} and V_{CB}.

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

$$= 15V - 29.7V.$$

$$= -14.7V$$

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

$$= 15.4\ V$$

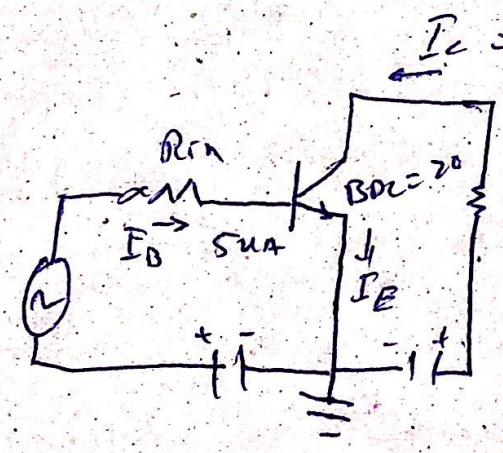
since the collector is set a lower voltage Then the base, the collector base junction is fowood biased.

Q no 3:

Ans:- for using BJT as an amplifier we need to set them in Active region because BJT working as an amplifier when use is active region.

Transistor has three Basis configuration for using it in Amplifier mode.

common Base voltge Gain no current.
common Emitter Both gain
common collector current gain no voltge.



so This is common emitter configuration of transistor which has both voltge & current amplification.

$$I_C = \beta \cdot I_B$$

$$= 200 + 5\mu A$$

$$I_C = 200.0005\,\mu A$$

$$I_E = I_C + I_B$$

$$I_E = 200.0005\mu A + 15\mu A$$

$$\boxed{I_E = 200.00002}$$

Q NO 4 : For a transistor to acts as a "switch" ----.

Answ

ON conditions

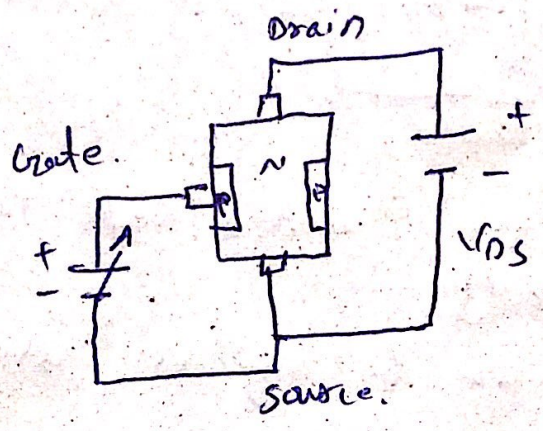
(i) Transistor fully on
(ii) Maximum of saturation current I_c flows.
(iii) BE Junction is forward bias.
(iv) BC " " forward bias.
(v) $V_{CE} = 0V$

OFF conditions

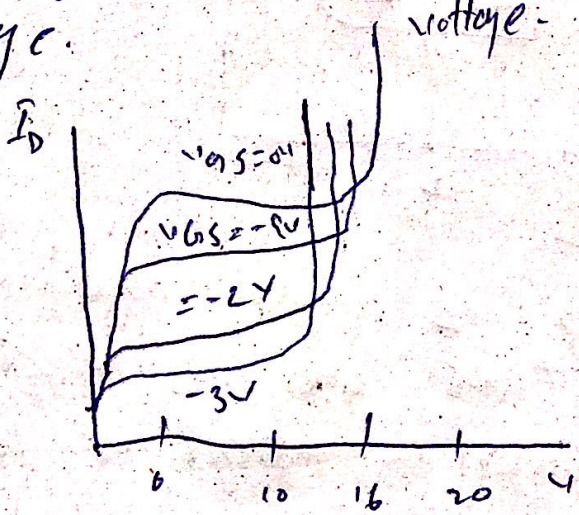
(i) Transistor fully off.
(ii) Input and base are at 0V
(iii) collector current $I_c = 0$
(iv) $V_{CE} = V_{cc}$
(v) BE junction is reverse bias.
(vi) BC " " bias.
(vii) BE junction is less than 0.7v.

Q No 5 :-

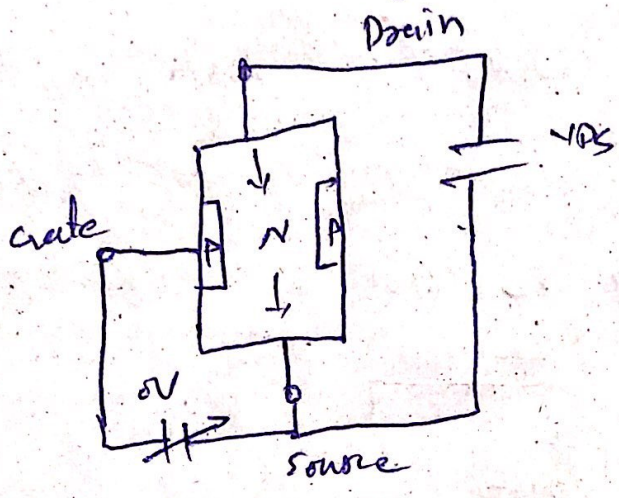
Ans:- JFET is a type of junction field effect transistor which is voltage controlled device as differ from BJT which is current controlled.



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.

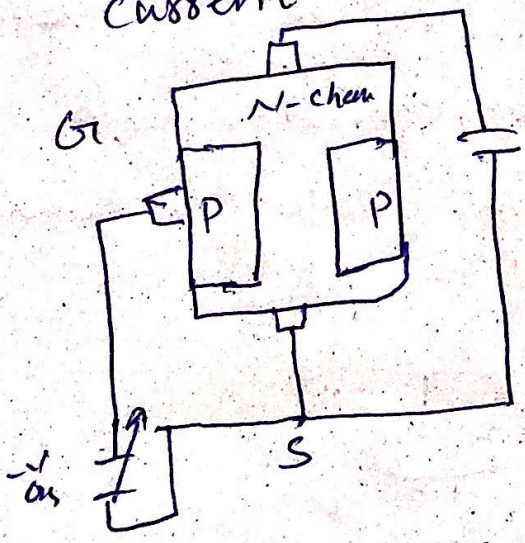


so if we see to the graph whith the no voltge applsed to the gate the current flows freely.



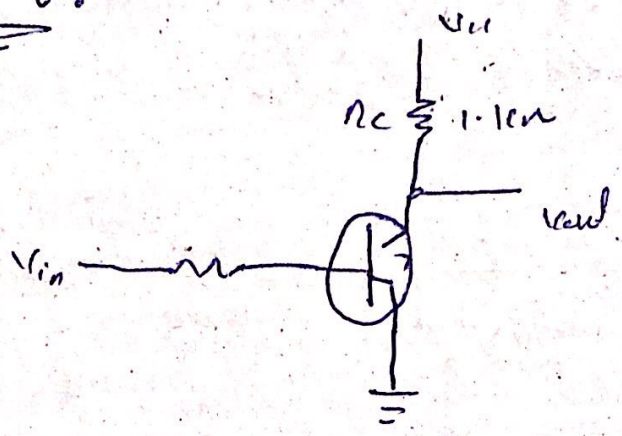
The channel are wider and Drain current moves freely.

If we move Vgs to negative value the channel width start to decreases and current cannot moves.



so Vgs is more negative so no current flows and this effect is called Pinch off region no current or less current flow.

Q.No 6:- ①



Given data:

$\beta_{DC} = 125$

$V_{cc(sat)} = 0.4V$

$R_C = 1\,k\Omega$

$V_{cc} = 10V$

Required:

$V_{CE} = ?$ $I_B = ?$

Sol:-

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

when $V_{in} = 0V$, so transistor is in cutoff mode and

$V_{CE} = V_{cc} = 10V$

(b) min $I_B = ?$ $\beta_{DC} = 125$ $V_{CE} = 0.4$

$I_{c(sat)} = \frac{V_{cc}}{R_C} = \frac{10V}{1k\Omega} = 10mA.$

(2)

$$I_{B(min)} = \frac{I_{c(sat)}}{\beta_{DC}} = \frac{10mA}{125} = 80\,\mu A$$