-: COURSE DETAILS: -

Course tittle :- EDC

Module :- 3rd

Instructor :- Dr- Shahryar

-: STUDENT DETAILS: -

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Q No. 1:-

The IN4747A zener used in the regulator circuit of Figure 1 is a 20V diode, determine the following-

ⓐ :- Determine Vout at I_{ZK} and at I_{ZM}.

Sol:-

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

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

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

$$V_{out} = 20 - (0.01225)(22)$$

$$V_{out} = 20 - 0.2695$$

$$V_{out} = 19.7305\ V$$

Know calculate zener max current the maximum power dissipation is 1W.

$$I_{ZM} = \frac{P_D(max)}{V_Z} = \frac{1W}{20} = 0.066667$$

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

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

for I_{zm}

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

$$= 20V + (50mA - 12.5mA)\, 22\,\Omega$$
$$= 20V + (37.5mA)\, 22$$
$$= 20V + 0.825$$

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

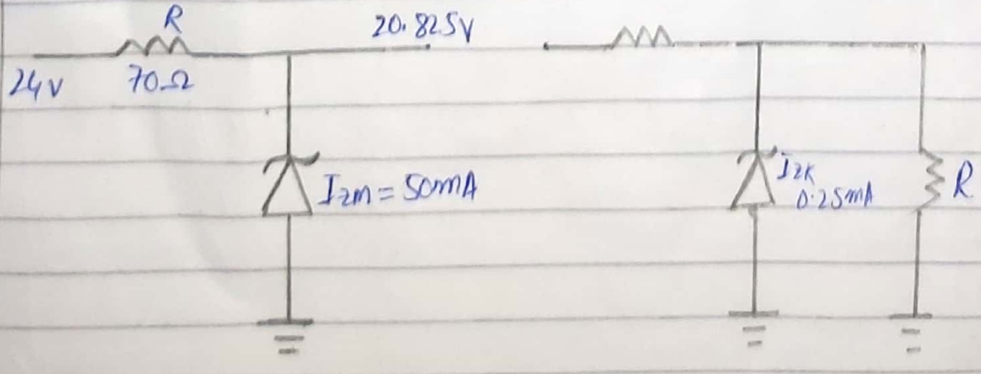
(B) Calculate the value of R for maximum zener current as shown in figure.

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

$$= \frac{24V - 20.825V}{50\ mA}$$

$R = 63.5\ \Omega$

$R = 70\ \Omega$ (Nearest largest standard



Qc:- for maximum load Resistance (maximum current) the zener diode current minimum ($I_{ZK} = 0.25$).

$$I_T = \frac{V_{in} - V_{out}}{R}$$

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

$$I_T = 0.061 A$$

$$I_T = 61 mA$$

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

$$I_L = 61 - 0.25 mA$$

$$I_L = 60.75 mA$$

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

$$R_L = \frac{19.3}{0.0675}$$

$$R_L = 285.92 \Omega$$

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

Q NO.2:- Determine I_B, I_C, I_E; V_{BE}, V_{CE} and V_{CB} in the circuit shown in Figure 2.

Solution:-

Given $V_{BE} = 0.7V$

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

$$I_B = 1102 \mu A$$

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

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

$$I_E = I_C + I_B = 1653 mA + 1102 \mu A$$

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

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

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

$$= 15V - 29.7V$$

$$\boxed{V_{CE} = -14.7 V}$$

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

$$\boxed{V_{CB} = -15.4V}$$

Since the collector is at a loner voltage then the base, the collector-Base junction is forward-Biased.

Q NO. 3:-

Bipolar Junction Transistor:

BJT:-

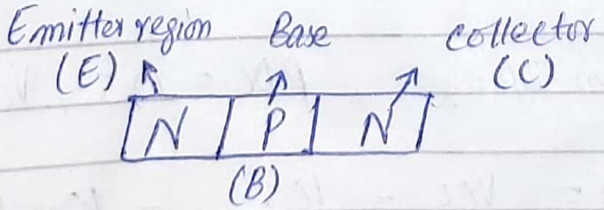
Transistor as

→ Inverted in Dec 1947 at bell labs at USA.

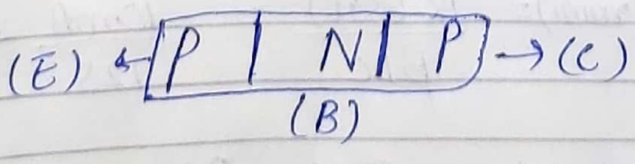
→ BJT is a three terminal device and it is used in amplification of weak signals used in switching operation.

→ Physical structure:-

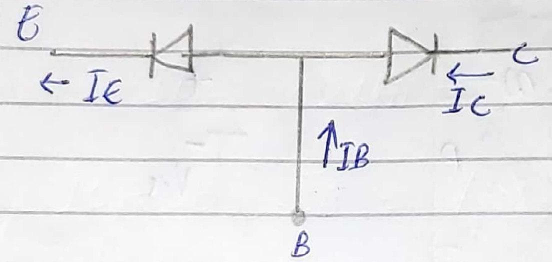
NPN

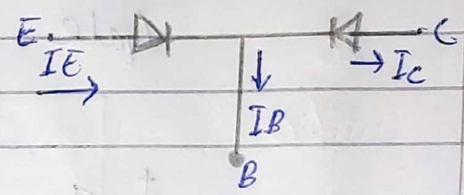


PNP

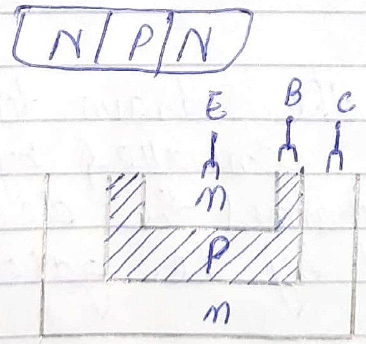


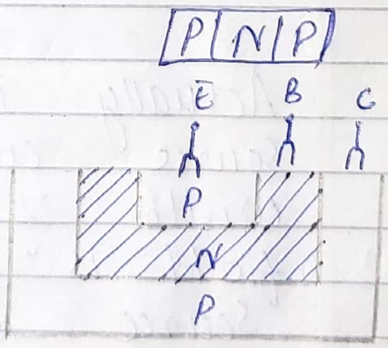
→ 2 junction (N)
→ 1 junction (P)   width C > E > B
→ J_1 → emitter - Base   deping E > C > B
→ J_2 → collector → Base
→ There is deplation Region at J_1
→ There is depletion region at J_2 -



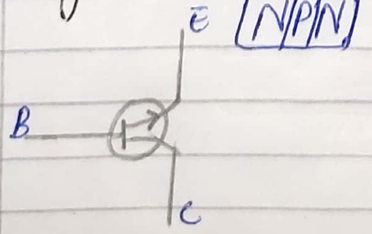


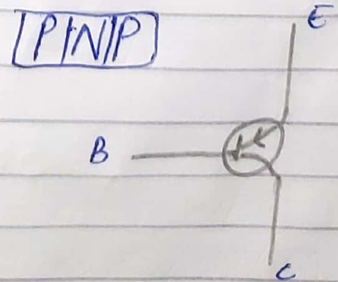
↳ Section View :-





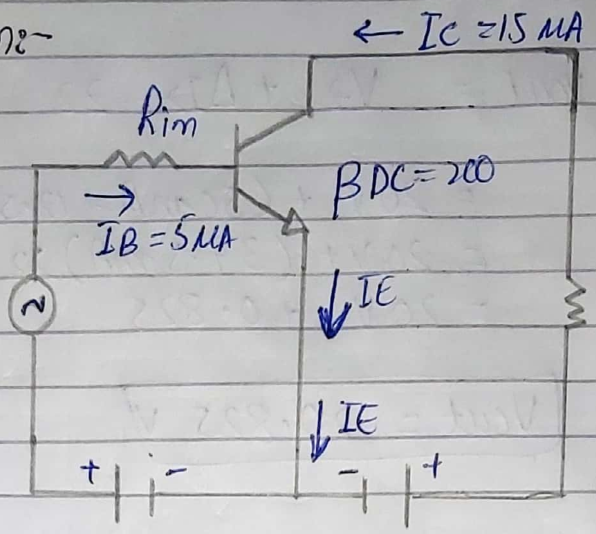
↳ Symbol :-





→ Increase of NPN these will more from B → E.

Diagram:-



So this is Common emitter Configuration of transistor which has both voltage and current amplification.

$$IC = \beta \cdot IB$$
$$= 200 + 5 \mu A$$
$$Ic = 200.00005 \mu A$$

$$IE = IC + IB$$
$$IE = 200.00005 \mu A + 15 \mu A.$$

$$\boxed{IE = 200.00002}$$

Q No. 4:-

For a transistor to act as a "switch", you need to join each of the following conditions on the left to "NO" or "OFF" state.

Transistor fully (ON)

Transistor fully (OFF)

Input and base are at 0V (OFF)

Collector current $I_C = 0$ (OFF)

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

BE junction is Reverse biase (OFF)

BC junction is Foward bias (OFF)

Maximum of saturation current I_C flows (ON)

BE Junction is Forward Bias (ON)

BC junction is forward Bias (ON)

$V_{CE} = 0V$

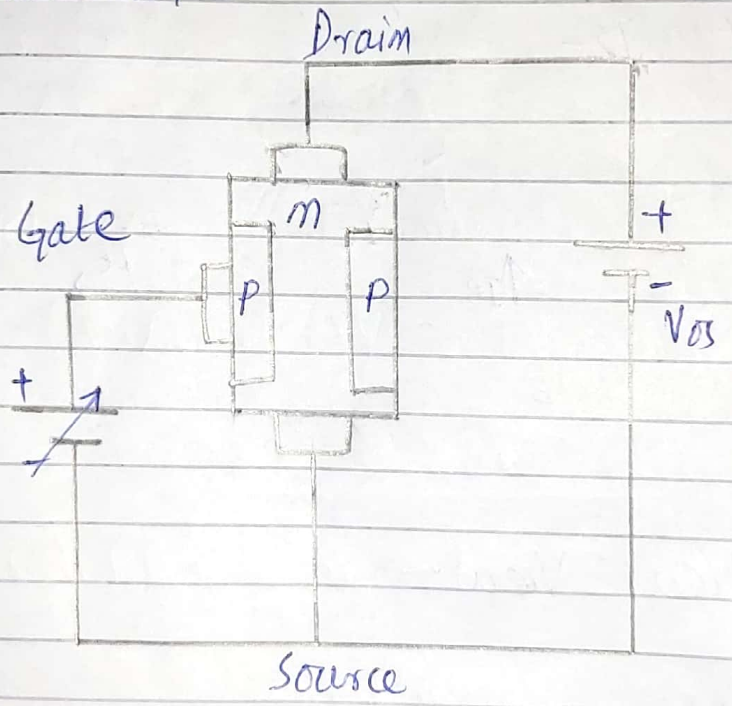
BE - junction is less then 0.7V (OFF).

ON

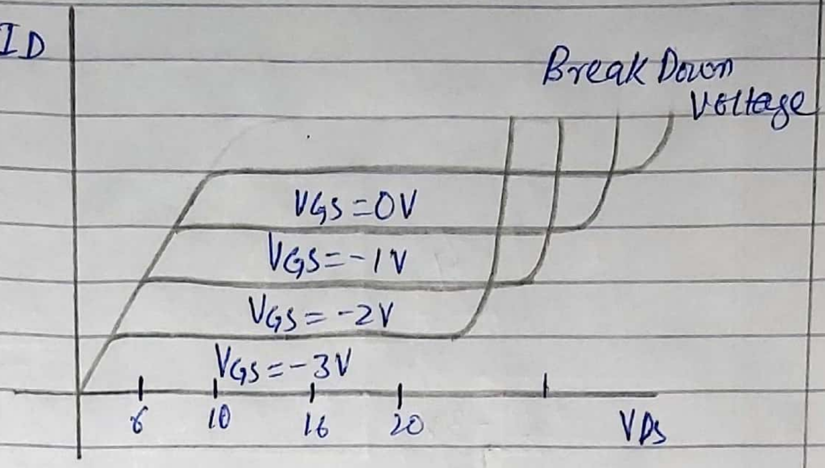
OFF

QNO.5:-

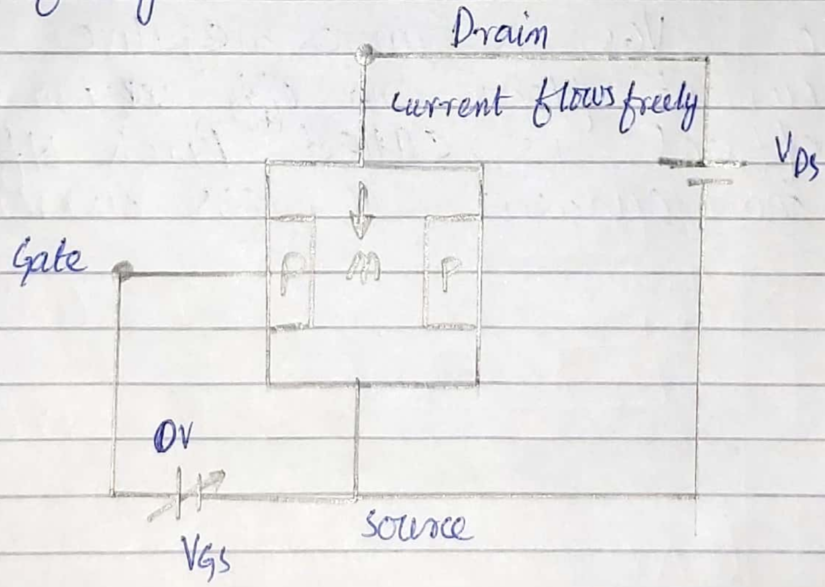
JFET is a type of ~~transistor~~ junction field effect transistor which is voltage controlled device as differ from BJT which is current controlled.



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 with the no voltage applied to the gate the current flows freely



The channel are wider and Drain current moves freely.
If we move V_{GS} to negative value the channel width start to decrease and current cannot moves.

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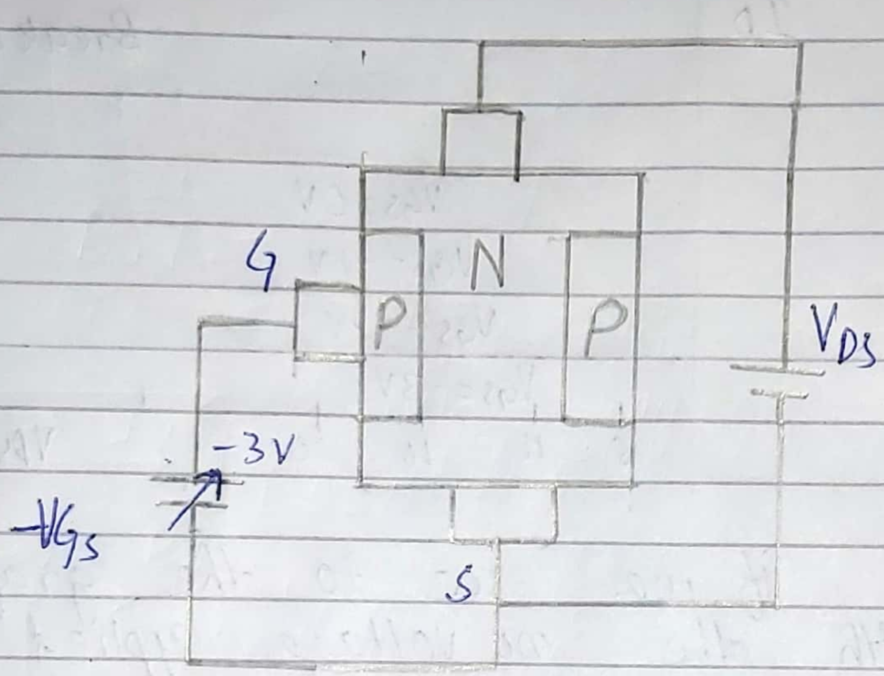

so V_{GS} is more negative so no current flows and this effect is called Pirch off region no current or less current flows.

Q NO. 6 :-

For the transistor circuit given in Fig 3, Calculate the following :-

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

Sol:- When $V_{IN} = 0V$, so transistor is in cut OFF mode and

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

(B) Determine the minimum value of I_B is required to saturate this transistor if β_{DC} is 125 and $V_{CE(sat)}$ is 0.4V.

Sol:- min $I_B = ?$, $\beta_{DC} = 125$, $V_{CE(sat)} = 0.4V$

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

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

$$I_{B(min)} = 80\mu A.$$

$$\therefore \boxed{I_{B(min)} = 80\mu A} :-$$