Electronic device and circuit

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Summer

Q=4:-

For a transistor to act a "switch" you need to join each of the following condition on the left "ON" or "OFF state.

Transistor Fully ON
Transistor Fully OFF
Input and base are at 0V
Collector Current $I_C = 0$

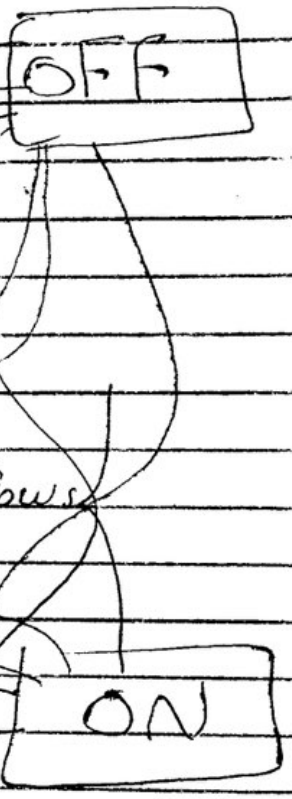
$V_{CE} = V_{CC}$
BE junction is reverse bias
BC junction is Forward bias

Maximum of Saturation Current I_C flows

BE junction is Forward bias
BC junction is Forward bas

$V_{CE} = 0V$

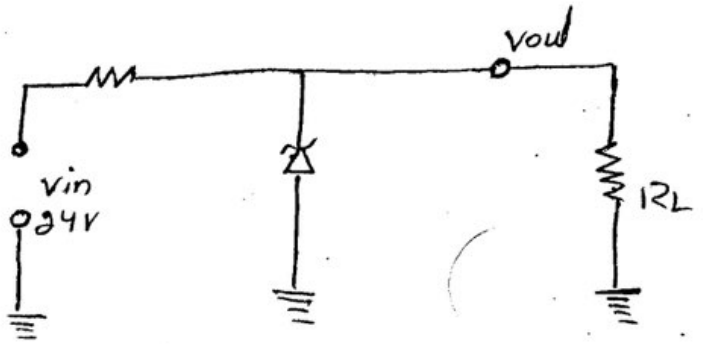
BE junction is less then 0.7V



Q1:- Part (a)

Find the date Sheet

Sol:-



From the datesheet IN4747A

$V_Z = 15$ a) $I_Z = 12.5$ and $Z_Z = 22\ \Omega$

$I_{ZK} = 0.25$

(a) For I_{ZK} :-

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

$$= 15 - (I_Z - I_{ZK}) Z_Z$$

$$= 15 - (12.25\ mA)\ (22\ \Omega)$$

$$= 15V - (0.01225)\ (22)$$

$$= 15V - 0.2695$$

$$= 14.7305\ V$$

Calculating Zener Max current the maximom Power dissipation is 1w

$$I_{ZM} = \frac{P_{D(max)}}{V_Z} = \frac{1W}{15} = 0.066667A$$

$$I_{ZM} = 66.7mA$$

For I_{ZM} :

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

$$= 15 + \Delta I_Z Z_Z$$

$$= 15V + (I_{ZM} - I_Z) Z_Z$$

$$= 15V + (54.2mA)(22\Omega)$$

$$= 15V + (0.0542)(22)$$

$$= 16.1924V$$

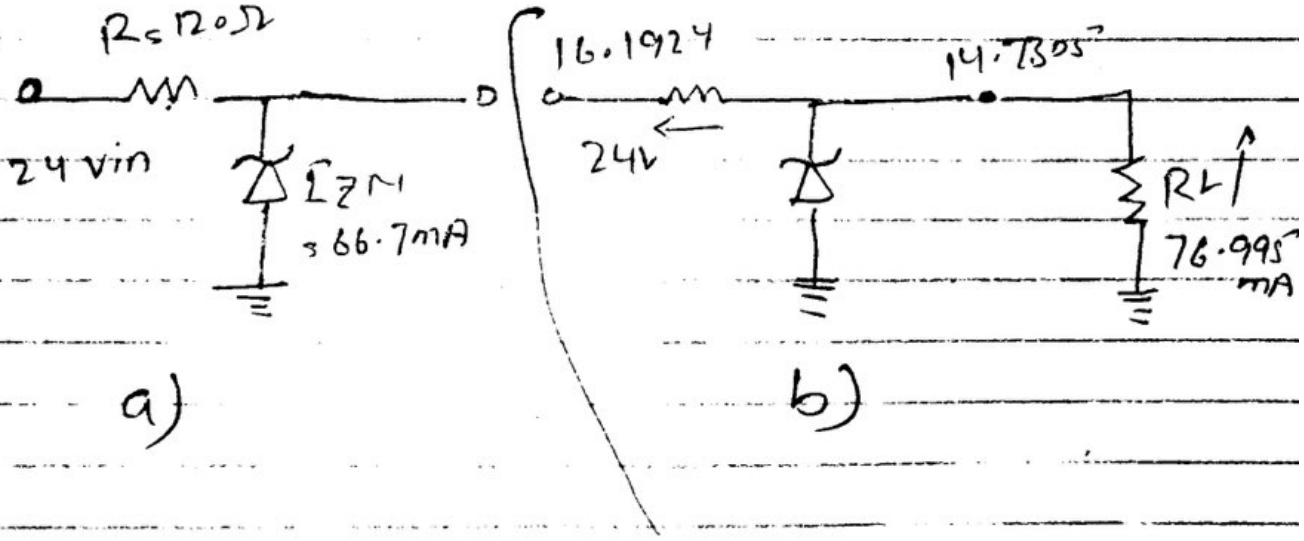
Part B :- calculate value of R For Max zener current that occurs when there is no load

$$R = \frac{V_{IN} - V_{out}}{I_{ZM}}$$

$$= \frac{24V - 16.1924V}{I_{ZM}} = \frac{7.8076}{66.7mA}$$

$$= 116.5313$$

$R = 120\Omega$



a) b)

Part C

For the minimum Level visistance (maximum load current) the Zener current is ($I_{ZK} = 0.25$ mA)

$$I_T = \frac{V_{in} - V_{out}}{R} = \frac{24 - 14.7305}{120\ \Omega}$$

$$I_T = 0.077245$$

$$I_T = 77.245\ mA$$

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

$$= 77.245 - 0.25\ mA$$

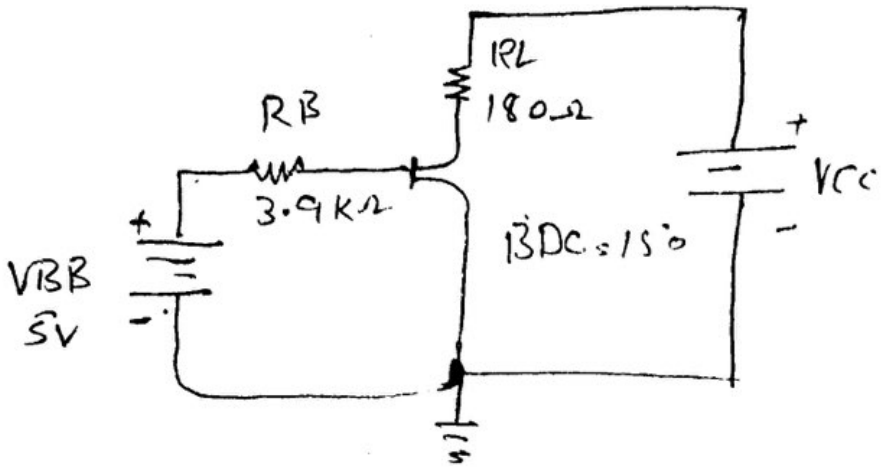
$$I_L = 76.995\ mA$$

$$R_{L(min)} = \frac{V_{out}}{I_L} = \frac{14.7305}{76.995\ mA} = \frac{14.7305}{0.076995}$$

$$= 191.317618\ \Omega$$

$$R_{L(min)} = 192\ \Omega$$

Qs 2 :- Determine I_{IB}, I_C, I_E, V_{BC}, V_{CE} and V_{CB} in the Circuit shown in fig 2



Sol :-

$\Rightarrow V_{BE} = 0.7V$

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

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

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

Solve for V_{CE} & V_{CB}

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

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

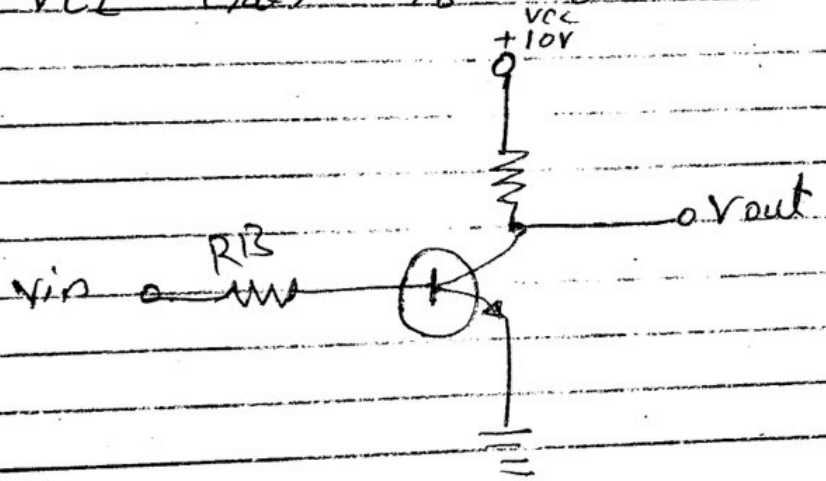
$V_{CB} = V_{CE} - V_{BE} \Rightarrow -14.7V - 0.7V$

$= \boxed{-15.4V}$

Qs6 For the transistor circuit given in Fig 3 calculate the following.

a) What is VCE when Vin = 0V?

B) Determine the maximum value of IB is required to saturate this transistor if BDC is 125 and VCE (sat) is 0.4V



Solution:-

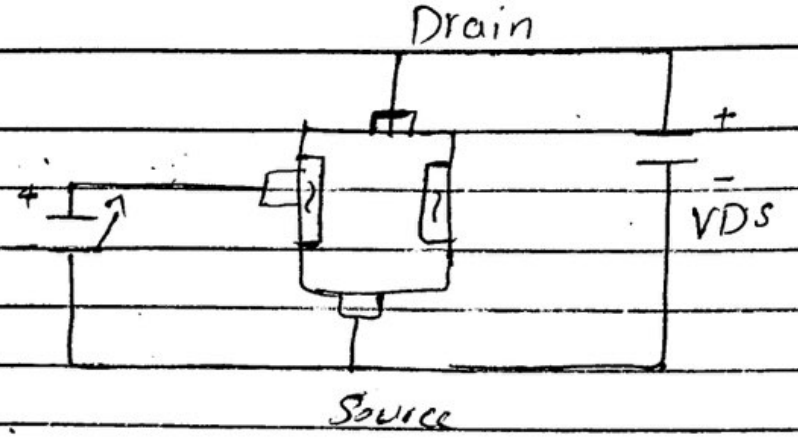
Part (a):-

VCE = ? Vin = ON

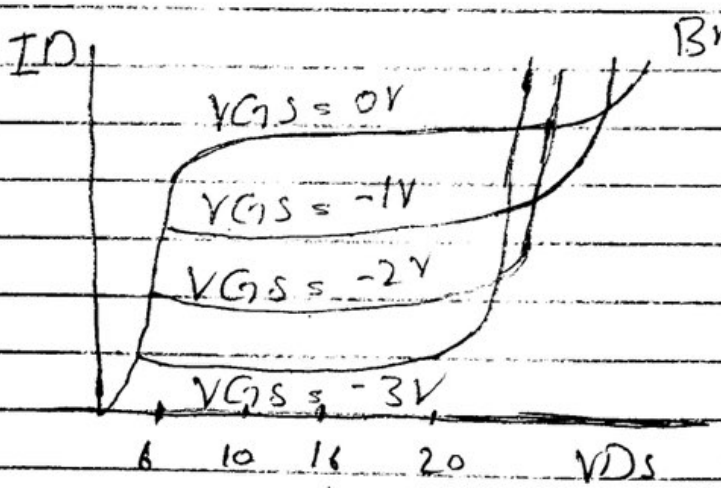
When Vin = ON → so transistor is in cutt off mo and VCE = Vcc = 10V.

Qs 3-

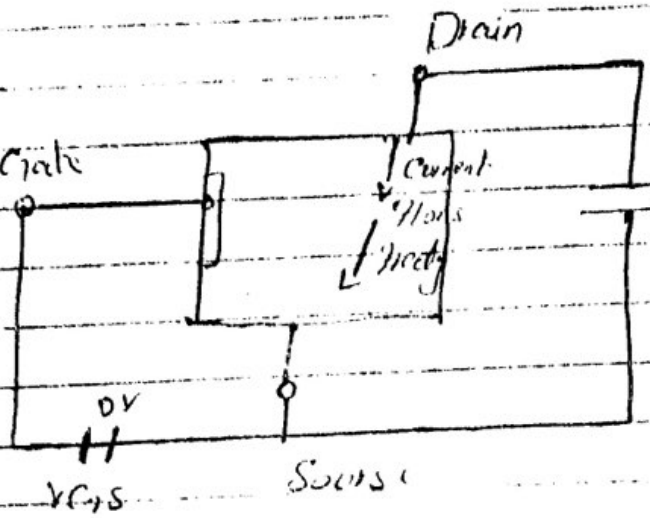
JFET is a type of junction field effect transistor which is voltage controlled device as differ from BJT which is current controlled.



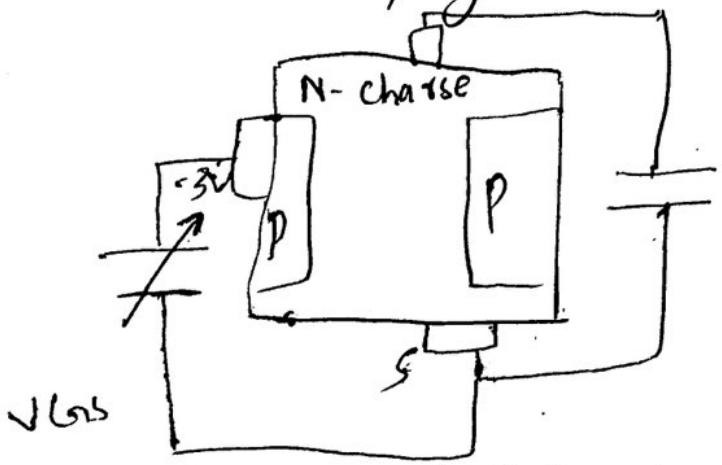
Acctually in FET the drain to Source current is controlled by the width of the channel the electric Field is produced by the gate to Sourse Voltage



So if we see to the graph with the zero voltage applied to the gate the current flows freely



The channel are wider and Drain current moves freely if we more VGS to negative value the channel width start to decreases and current cannot moves



So VGS is mor negative

So no current flows and

this effect is called pinch

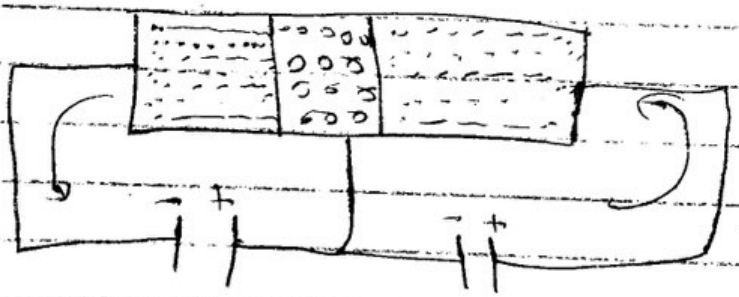
off region no current or

. less current flows

Q38-

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

1) F.B	Active	Amplifier
2) F.B	saturation	no switch really used
3) R.B	Cut off	BJT
4) R.B	Invested	



the diagram shows the basic configuration using BJT in active region.