Course : Electonic device & circuits

: : Summer Semester

Instructor : Dr. Shavyar Shafiq

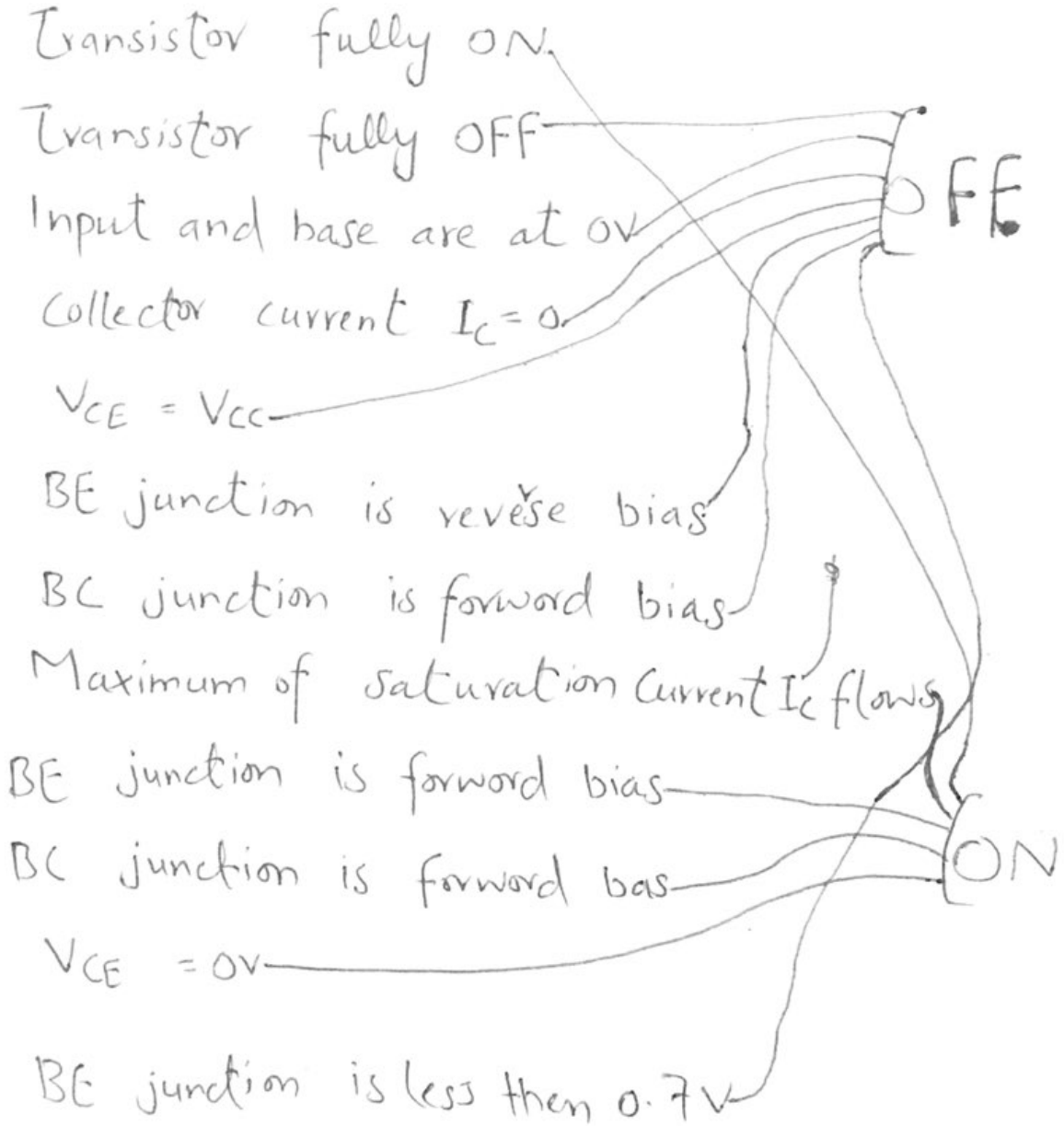
Name : Farhan Ali

ID : 14873

Signature : 

f. Q4:-

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

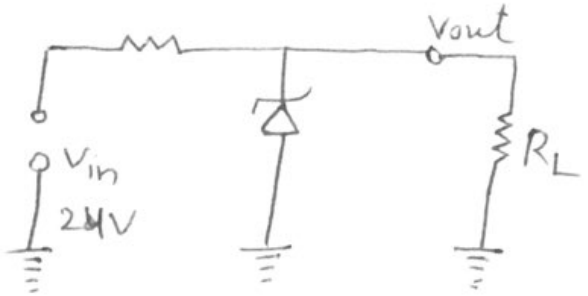


Q1:-

Part (a):-

Find the data sheet

Sol:-



from the datasheet 1N4747A

$V_z = 15^-$ @ $I_z = 12.5^-$ and $Z_z = 22\Omega$

$I_{ZK} = 0.25^-$

(a) for I_{ZK}:-

$$V_{out} = V_z - 0 I_z Z_z$$

$$= 15^- - (I_z - I_{ZK}) Z_z$$

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

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

$$= 15V - 0.2695^-$$

$$= 14.7305V$$

Calculating Zener Max Current the matimum Power dissipation is 1W

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

$$I_{ZM} = 66.7mA$$

for I_{ZM}:

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

$$= 15V + \Delta I_Z Z_Z$$

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

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

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

$$= 16.1924V$$

Part B:-

Calculate value of R for Max Zener Current that occurs when there is no load

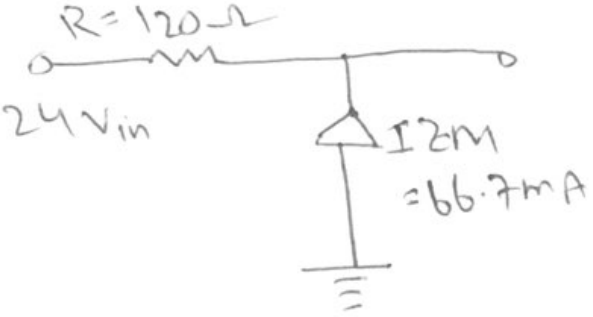
$$R = \frac{V_{IN} - V_{out}}{I_{ZM}}$$

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

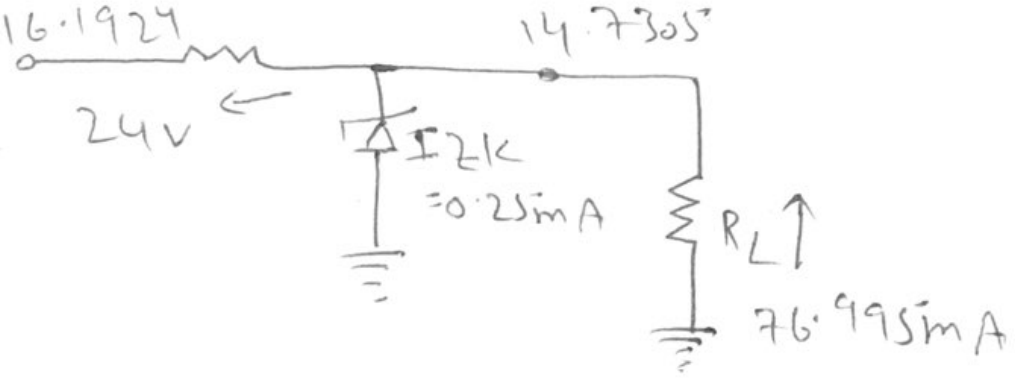
$$= 116.5313$$

$$R = 120\Omega$$

a)



b)



Part c

for the minimum level risistance (maximum load current) the Zener current is (I_{ZK}=0.25mA)

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

$$I_T = 0.077245$$

$$I_T = 77.245\,mA$$

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

$$= 77.245 - 0.25\,mA$$

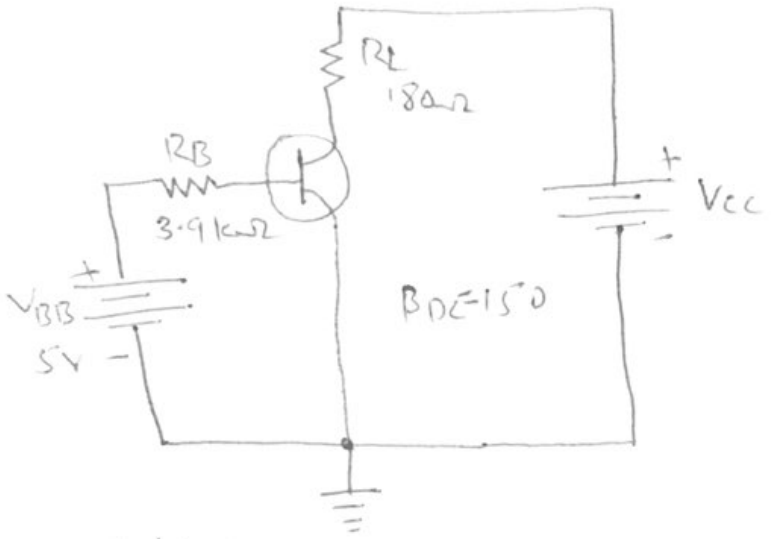
$$I_L = 76.995\,mA$$

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

$$= 191.317618\Omega$$

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

CC2 8- Determine I_B, I_C, I_E, V_{BE}, V_{CC} and V_{CB} ~~Ans:~~ ~~VBE~~ in the circuit shown in fig 2



Sol:-

$\Rightarrow V_{BE} = 0.7V$

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

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

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

Solve for V_{CE} & V_{CB}

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

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

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

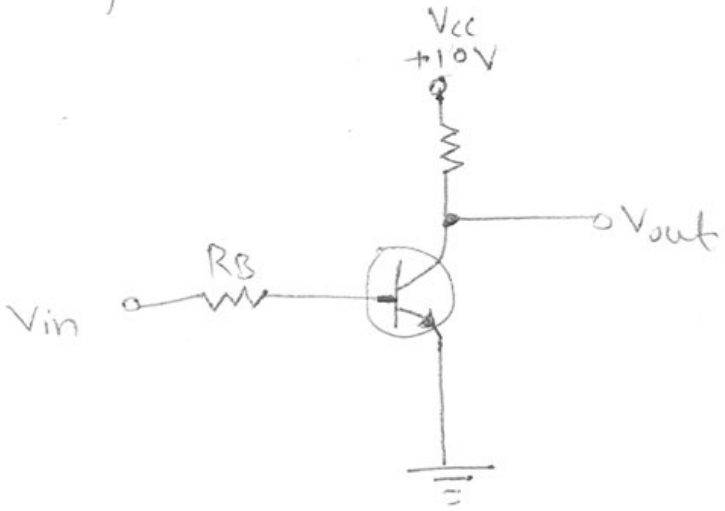
$$\boxed{= -15.4V}$$

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

CQ6:- For the transistor circuit given in Fig 3 calculate the following.

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

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



Solution:-

Part (a):-

$V_{CE} = ?$ $V_{in} = ON$

When $V_{in} = ON$, So transistor is in cutt off mode and $V_{CE} = V_{cc} = 10V$.

Part (B)

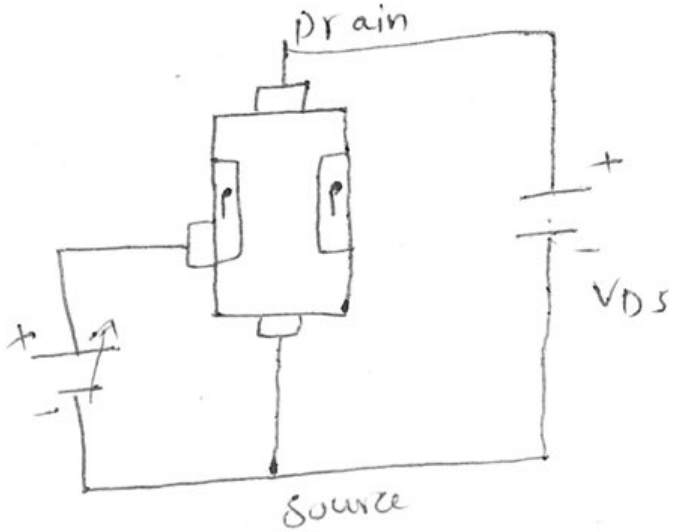
$\min I_B = ?$ $\beta_C = 125$, $V_{CE} = 0.4$

$$I_{C(sat)} = \frac{V_{CC}}{R_C} = \frac{10V}{1K\Omega} = 10mA$$

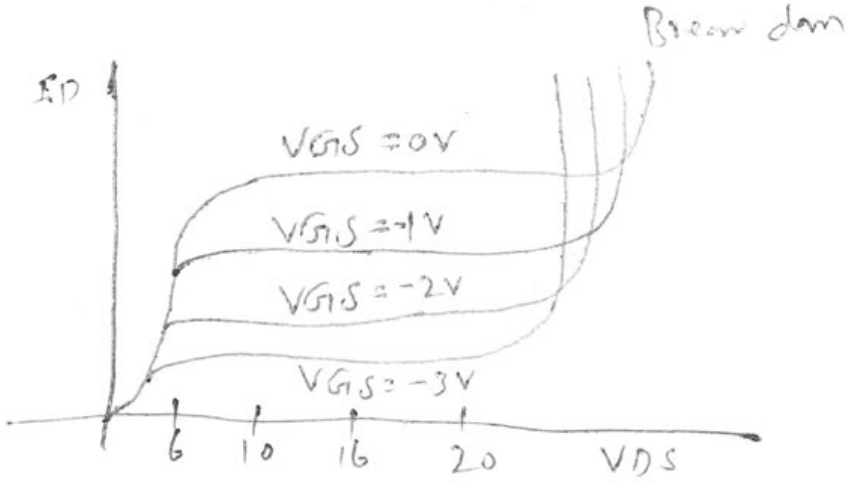
$$I_{B(min)} = \frac{I_{C(sat)}}{\beta_{DC}} = \frac{10mA}{125} = 80\mu A$$

Q5:-

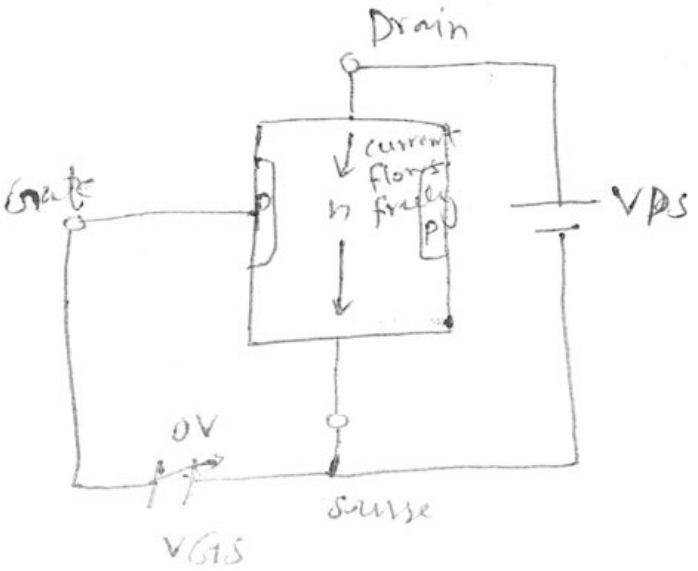
JFET is a type of junction field effect transistor which is voltage controlled device as differ from BJT which is current controlled



Actually in FET the drain to source current is controlled by the width of the channal the electric field is produced by the gate to sourse voltage.

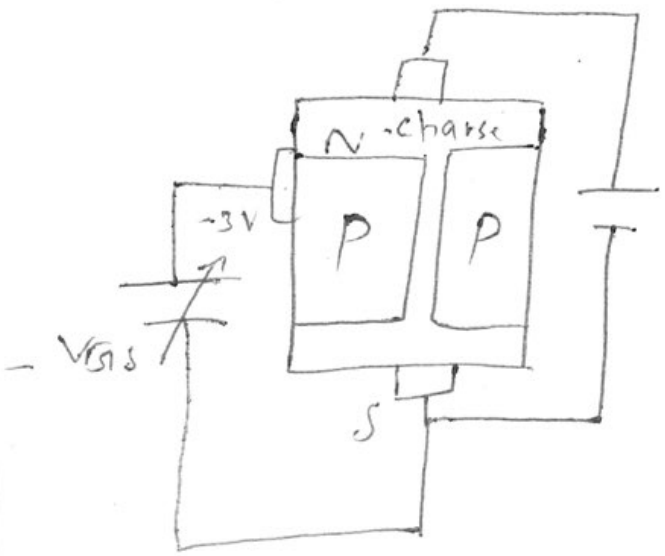


So if we see to the graph with the no voltage applied to the gate the current flows freely



the channel are wider and Drain Current moves freely

if we move VGS to negative value the channal width start to decreases and Current Cannot moves.



So V_{GS} is more negative

So no current flows and

~~off~~ This effect is called Pinch off region no current or less current flows.

Cl38-

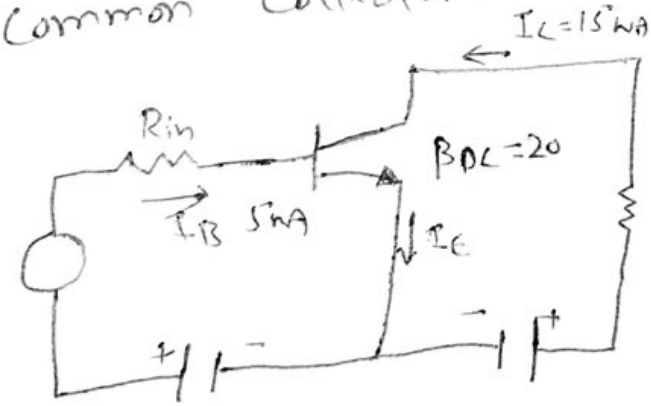
for using BJT as an amplifier we need to set them in Active region because BJT working as an amplifier when use is active region.

Transistor has three Basic Configuration for using it in Amplification mode

Common Base : voltage Gain Current

Common Emitter: Both gain

Common Collector: Current gain no voltage.



$I_C = B \cdot I_B$

$= 200 + 5\mu A$

$I_C = 200.00005\mu A$

$I_E = I_C + I_B$

$I_E = 200.00005\mu A + 15\mu A$

$I_E = 200.00002$