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Course title Electronic Device & circuit

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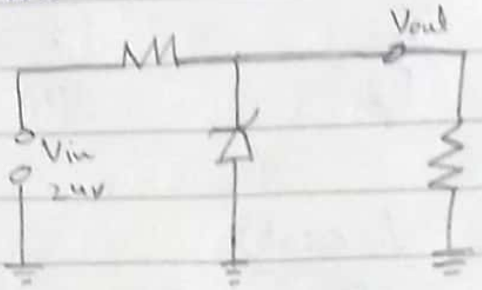
Q.1

From Data Sheet



from the Datasheet 1N4747A

$V_z = 20$ $I_z = 12.5$ & $Z_z = 22\Omega$

$I_{zk} = 0.25$

(a) for I_{zk} :->

$V_{out} = V_z - \Delta I_z I_z$

$= 20 - (I_z - I_{zK}) Z_z$

$= 20 - (12.25)(22\,\Omega)$

$= 20 - (0.01225)(22)$

$= 20 - 0.2695$

$= 19.7305\ V$

Calculating Zener Max Current
the maximum power
dissipation is 1w

$I_{ZM} = \frac{P_D(max)}{V_z} = \frac{1w}{20} = 0.05$

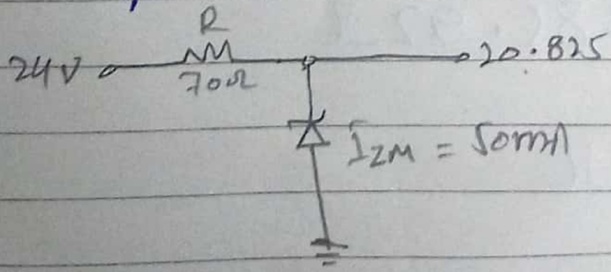
$I_{zm} = 50mA$

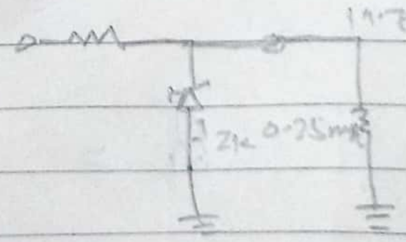
for I_{ZM}

$$V_{out} = V_Z + \Delta I_Z Z_Z$$
$$= 20V + (I_{ZM} - I_Z) Z_Z$$
$$= 20V + (50mA - 12.5mA)\, 22\Omega$$
$$= 20V + (37.5mA) 22$$
$$= 20V + 0.825$$
$$V_{out} = 20.825\ V$$

(b) Calculate the value of R for maximum Zener Current when there is no load as shown in figure

$$R = \frac{V_{in} - V_{out}}{I_{ZM}}$$
$$= \frac{24V - 20.825V}{50mA}$$
$$R = 63.5\Omega$$
$$R = 70\Omega \text{ (Nearest largest standard)}$$





(C) for maximum load Resistance (maximum Current) The Zener diode current minimum ($I_{ZK} = 0.25$)

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

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

$= 0.061 A$

$= 0.061 A$

$I_T = 61 mA$

$I_L = I_T - I_{ZK}$

$= 61 - 0.25 mA$

$I_L = 60.75 mA$

$R_{L} = V_{out}/I_L \quad 19.3/60.75 = 19.3/60.75 mA$

$= 19.3/0.0675$

$= 285.92 \Omega$

$R_L = 286 \Omega$

Q2

$V_{BE} = 0.7V$

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

$= 1102 \mu A$

$\Rightarrow I_c = \beta_{DC} I_B \Rightarrow (150)(1102) = 165.3 mA$

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

$\Rightarrow 166.4 mA$

Solve for V_{CE} & V_{CS}

$V_{CE} = V_{cc} - I_c R_c = 15v (165.3 mA)(180 \Omega)$

$\Rightarrow 15v - 29.7v$

$= 14.7v$

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

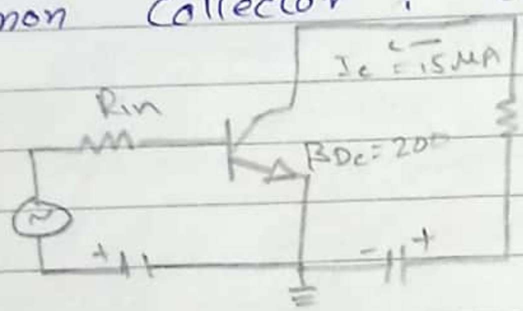
$\Rightarrow -15.4v$

Since the collector is at a lower voltage then the lose the collector base junction is forword Biased.

Q3 Using BJT as an amplifier we need to set them in Active region because BJT working as an amplifior when use is active region

Transistor has three Basic configuration for using it in Amplification mode

Common Base : Voltge Gain No current
Common Emitter : Both Gain
Common Collector : Current Gain no Voltage.



this is common emitter configuration of transistor which has both voltage & current amplification

$I_c = \beta I_B$
$= 200 + 5\mu A$

$I_c = 200.00005\,\mu A$

$$I_E = I_C + I_B$$

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

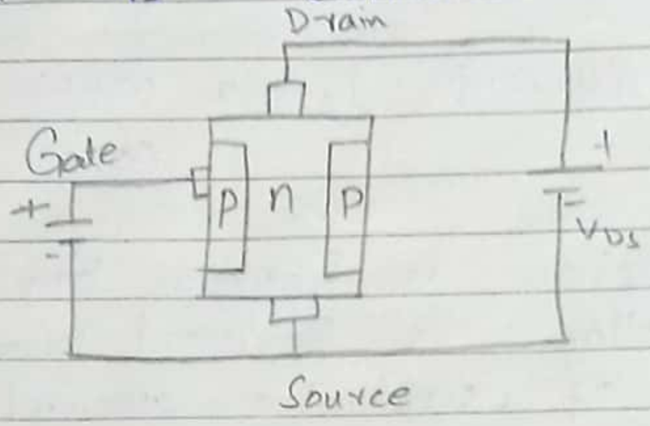
$$I_E = 200.00002.$$

Scanned with CamScanner

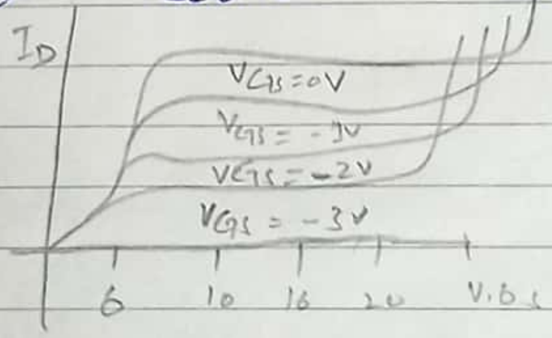
Q4

Transistor fully (ON)	
" fully (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 Forword bias	(OFF)
Maximum of saturatio current I_c flows	(ON)
BE Junction is Forword bias	(ON)
BC Junction is forword bias	(ON)
$V_{CE} = 0V$	(ON)
BE junction is less than 0.7 V	(OFF)

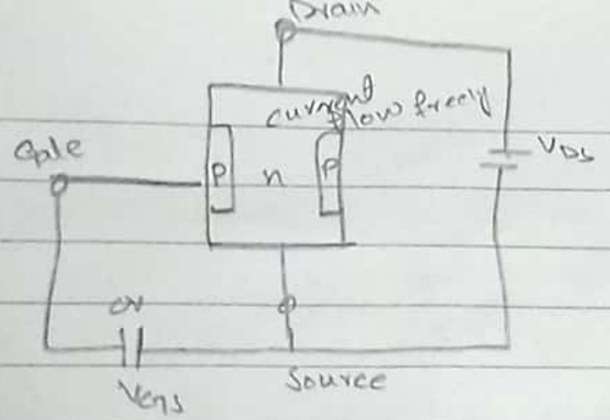
Q5 :-> JFET is type of junction field effect transistor which is voltage controlled device as differ form BJT which is current controlled



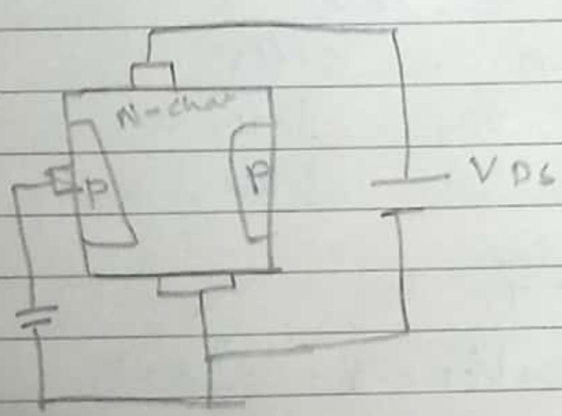
Actually FET The drain to source current is controlled by width of channel the E.Field is produced by the gate to source voltage.



If we see to graph whith the no voltage applied to the gate the current flow freely.

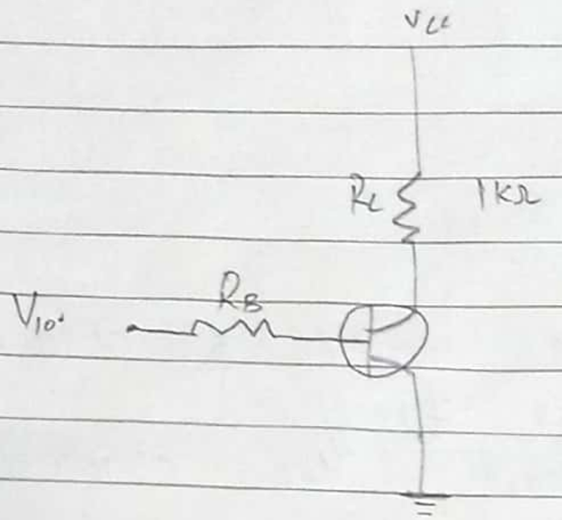


Channel are wider & drain current moves freely.
if we move the channel. width start decrease & current cannot move.



So VGS is more negative so no current flow & this effect is called Pinch off region no current or less current flows.

Q6



Given data :->

$B_{DC} = 125$

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

$V_{CC} = 10V$

$R_C = 1k\Omega$

Required

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

Sol :->

(a) $V_{CE} = ?$

$V_{IN} = ON$

when $V_{IN} = ON$ so transistor is in cutt off mode and

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

(b) min $I_B = ?$

$B_{DC} = 125$

$V_{CE} = 0.4$

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

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

$$= \frac{10mA}{125} = 80 \mu A$$