IQRA NATIONAL UNIVERSITY
Phase II,Hayatabad peshawer

Student: Hayat ahmad khan ID# 14486

Dept: BS (CS) Assignment:01 Subject: Basic Electronic

Q1: -

a. Explain how JFET works, including the pinchoff and gate-source cutoff voltage?
b. Draw the drain curves and the transconductance curve for a JFET?
c. Compare the JFET and the bipolar junction transistor. Also explain the advantages and disadvantages of each?

Answer:-

(a):

Working of JFET:-

A typical JFET has an input resistance in the hundreds of megohms. This is the big advantage that a JFET has over a bipolar transistor. It is the reason that JFETs excel in applications in which a high. input impedance is required. One of the most lmportant applications of the JFET is the *source follower,* a circuit like the emitter follower, except that the input impedance is in the hundreds of megohms for lower frequencies.

Pinchoff Voltage:-

The pinchoff voltage *Vp* is the point at which further increases in *VDS* are offset by a proportional increase in the channel's resistariee. This means that if the channel resistance is increasing in direct proportion to *VDS* above *Vp, ID* must remain- the same above *Vp.*

Gate Source Voltage:-

In a JFET, the gate-to-source voltage *VGS* determines how much current flows between the source and the drain. When *VGS* is zero, maximum drain current flows through the JFET. This is why a JFET is referred to as a normally on device. On- the other hand, if *VGS* .is negative enough, the depletion layers touch and the drain current is cut off.

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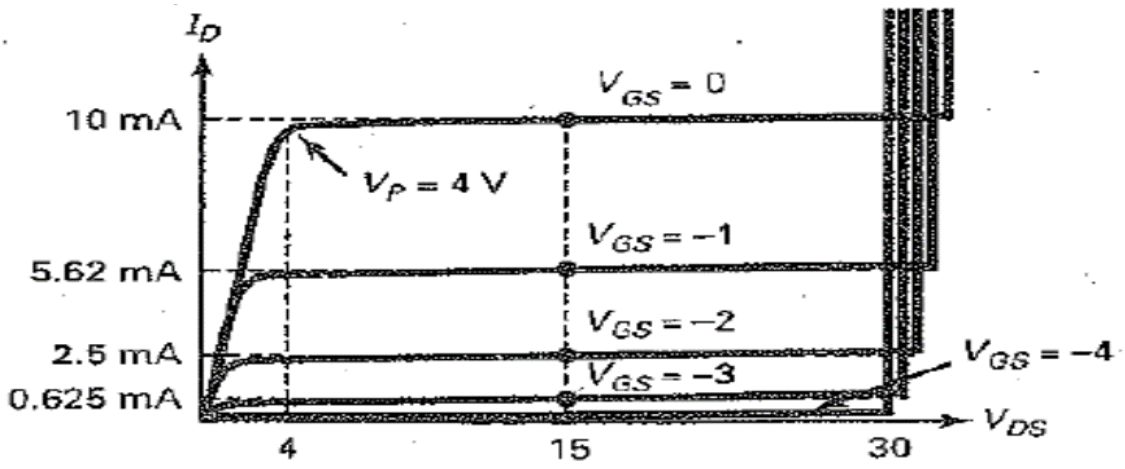
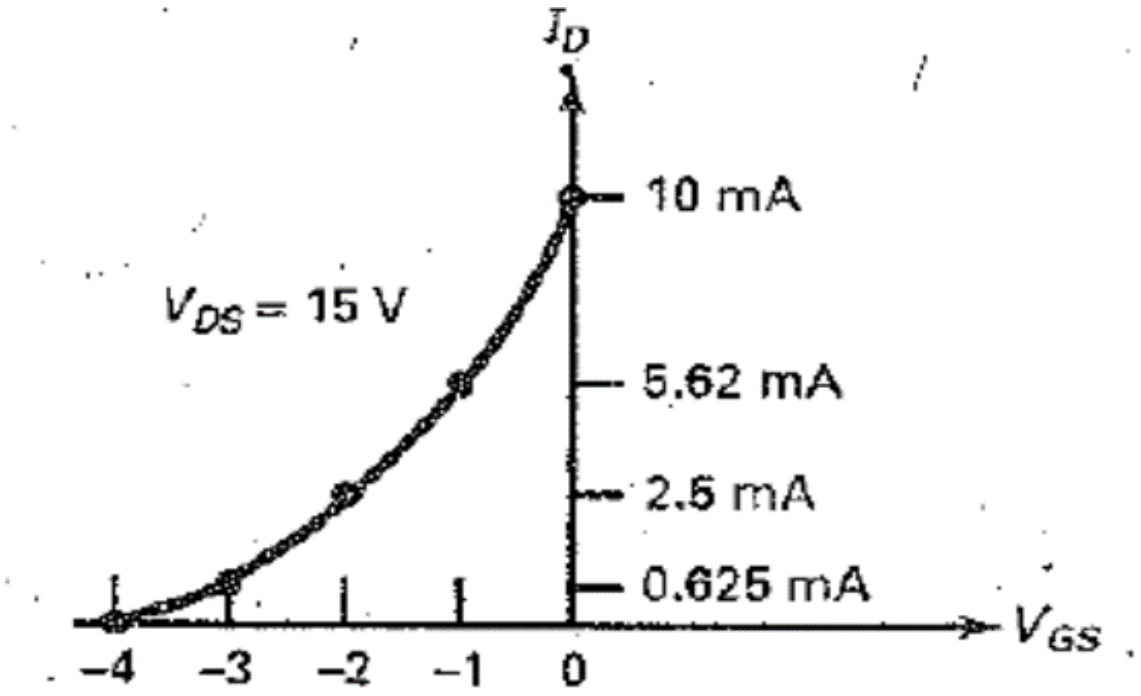
(b):

Drain curve of JFET:-



Transconductance Curve of JFET:-



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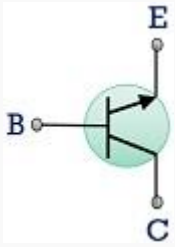
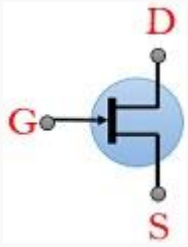
(c):

Comparison:-

PARAMETER	BJT	JFET
Carrier	Bipolar (majority and minority)	Unipolar (majority)
Symbol		
Device type	Current controlled device.	Voltage controlled device.
Input impedance	Low	High
Gain	High gain	Low - medium gain
Power consumption	It consumes more power.	It consumes less power.
Noise level	High	Low
Thermal stability	Low	High
Size	Large	Small

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PARAMETER	BJT	JFET
Application preference	It is preferred in low current application.	It is preferred in low voltage application.

Advantages and Disadvantages of JFET:-

Advantages of JFET:-

1. It is a unipolar device. The current conduction through the device is only through majority carriers either holes in P channel or electrons in N channel.
2. It is simpler to fabricate and occupies less space in integrated form.
3. It is an excellent signal chopper as it exhibits no offset voltage at zero drain current.
4. It is relatively more immune to radiation.

Disadvantages of JFET:-

1. The main disadvantage of the junction field effect transistor (JFET) is the relatively low gain bandwidth product.
2. The performance of JFET go downs as frequency increases due to feedback by internal capacitance.

Advantages and Disadvantages of Bipolar Junction Transistor:-

Advantages of BJT:-

1. The bipolar junction transistor (BJT) has a large gain bandwidth.
2. The BJT shows better performance at high frequency.
3. The BJT has a better voltage gain.
4. The BJT can be operated in low or high power applications.
5. The BJT has high current density.
6. There is low forward voltage drop.

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Disadvantages of BJT:-

1. The bipolar junction transistor (BJT) more noise produced.
2. The BJT are more effect by radiation.
3. BJT has a low thermal stability.
4. The switching frequency of BJT is low.
5. It has a very complex base control. So it may lead to confusion and requires a skilful handling.

Q2:-

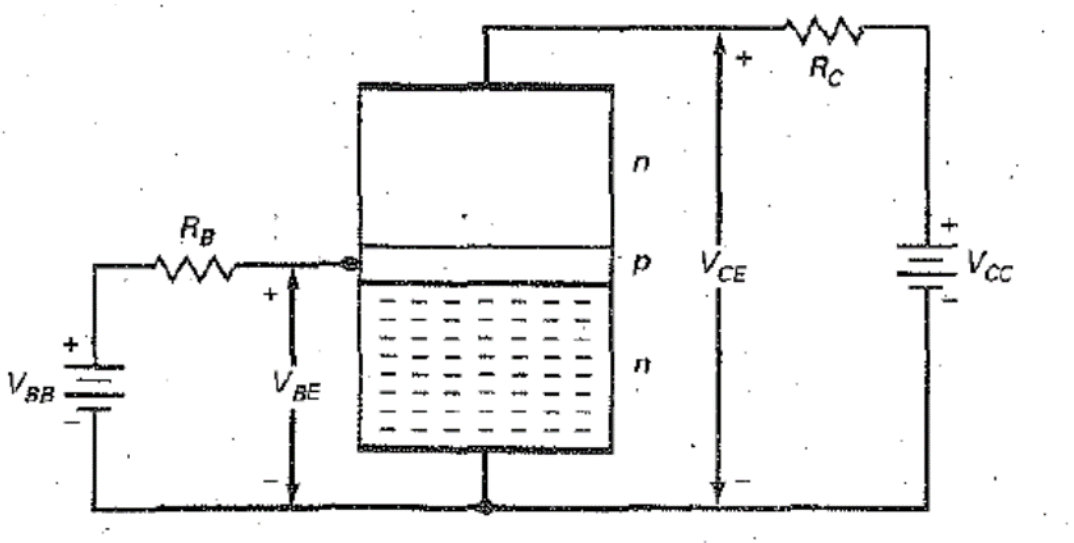
a. Draw an npn transistor showing the n and p regions. And then bias the transistor properly and explain how it works?

b. Draw a set of collector curves. Then, using these curves show how the four operating regions of a transistor?

Answer:-

(a):

NPN Transistor:-



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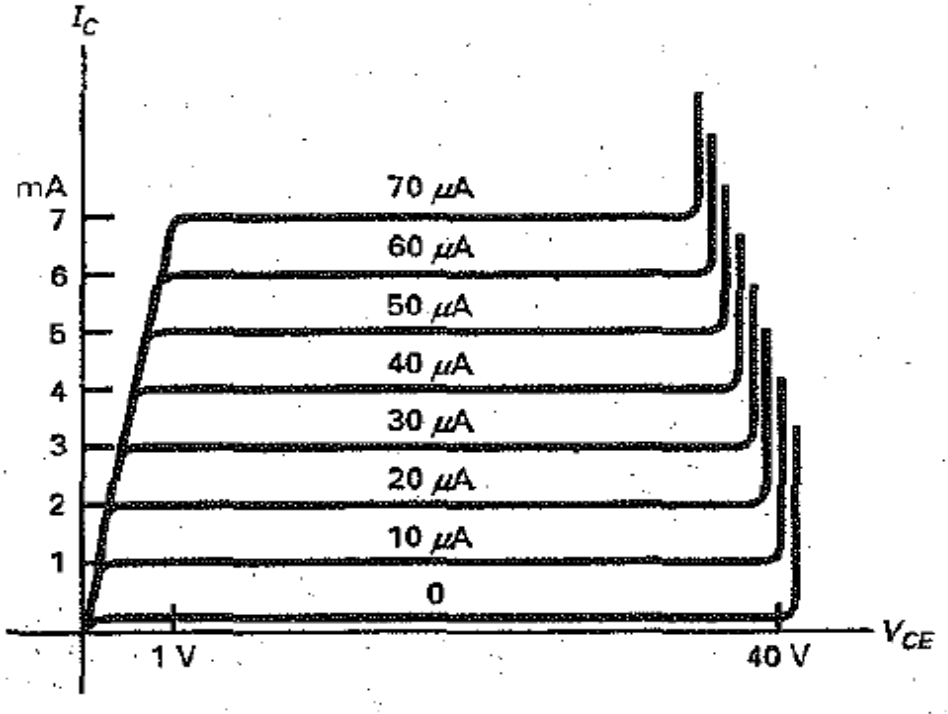
Bias the Transistor and Working:-

Figure above shows a biased transistor. The minus signs represent free electrons.The heavily doped emitter has the following job: to ernit or inject its free electrons into the base. The lightly doped base also has a .well-defined purpose: to pass emitter-injected electrons on to the collector. The collector is so named because it collects or gathers most of the electrons from the base.
Figure is the usual Way to bias a transistor. The left source V_{BB} of Figure forward-biases the emitter diode, and the right source V_{CC} reverse-biases the collector diode. Although other biasing methods are possible, forward-biasing the emitter diode and reverse-biasing the collector diode produce the most useful results.

(b):

Set of Collector Curves:-



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Operating Region of Transistor:-

1. **Active Region:-**
   Transistors operate in the active region when V_{CE} is between 1 and 40 V.

2. **Breakdown Region:-**
   The transistor should never operate in this region because it will be destroyed.

3. **Saturation Region:-**
   Transistors operate in the this region when V_{CE} is between 0 V and a few tenths of a volt.

4. **Cutoff Region:-**
   Transistors operate in the this region when base current is zero that we cannot see it. This small current is called collector cutoff current.