

## UNIT-2

### 1. Why MOSFET is called IGFET?

The construction of a MOSFET is a bit similar to the FET. An oxide layer is deposited on the substrate to which the gate terminal is connected. This oxide layer acts as an insulator (SiO<sub>2</sub> insulates from the substrate), and hence the MOSFET has another name as Insulated Gate Field Effect Transistor (IGFET).

### 2. What is thermal runaway?

The continuous increase in collector current due to poor biasing causes the temperature at collector terminal to increase. If no stabilization is done, the collector leakage current also increases. This further increases the temperature. This action becomes cumulative and ultimately the transistor burns out. The self destruction of an un stabilized transistor is known as thermal runaway.

### 3. Define the different operating region of transistor.

**Active region:** The collector junction is reverse biased and emitter junction is forward biased.

### 4. List out the different types of biasing.

- a. Voltage divider bias.
- b. Base bias
- c. Emitter feedback bias
- d. Collector feedback bias.

### 5. Why is the transistor called a current controlled device?

The output characteristics of the transistor depend on the input current. So transistor is called a current controlled device.

### 6. Define current amplification factor.

It is defined as the ratio of change in output current to the change in input current at constant other side voltage.

### 7. What are the requirements for biasing circuits?

- a. The Q point must be taken at the Centre of the active region of the output characteristics.
- b. Stabilize the collector current against the temperature variations.
- c. Make the Q point independent of the transistor parameters.

d. When the transistor is replaced, it must be of same type.

**8. When does a transistor act as a switch?**

The transistor acts as a switch when it is operated at either cutoff region or saturation region.

**9. Recall the term pinch off voltage of MOSFET.**

The drain voltage becomes large enough that the gate to substrate potential at the drain is smaller than threshold. Therefore the channel thickness at this end goes to zero. We call this pinch off

**10. Compare JFET and MOSFET.**

<b>JFET</b>	<b>MOSFET</b>
JFET(Junction Gate Field-Effect Transistor) is a three-terminal semiconductor device.	MOSFET(Metal-Oxide-Semiconductor Field-Effect Transistor) is a four-terminal semiconductor device.
can only operates in the depletion mode.	operates in both depletion mode and enhancement mode.
has high input impedance on the order of $10^{10}$ ohms, therefore they are more sensitive towards input voltage signals.	offers even higher input impedance than the JFETs, therefore they are more resistive.
allows the gate leakage current on the order of $10^{-9}$ A	While the gate leakage current for MOSFETs will be of the order of $10^{-12}$ A.
is relatively cheaper than MOSFETs	is expensive one.
these are ideal for low noise applications.	these are mainly used for high noise applications.
these are less susceptible to damage because of the high input capacitance.	these are more susceptible to damage because of the metal oxide insulator.
Manufacturing process of JFETs is simple.	Manufacturing process of MOSFETs is complex.
JFET(Junction Gate Field-Effect Transistor) is a three-terminal semiconductor device.	MOSFET(Metal-Oxide-Semiconductor Field-Effect Transistor) is a four-terminal semiconductor device.

**11. Compare SCR with TRIAC.**

<b><u>SCR</u></b>	<b><u>TRIAC</u></b>
<b>SCR</b> stands for silicon controlled rectifier.	<b>TRIAC</b> stands for triode for alternating current.

The SCR is unidirectional device.	The TRIAC is bidirectional device.
It available in large ratings.	It available in smaller ratings.
The SCR control DC power.	The TRIAC control DC as well as AC power.
The SCR can be triggered by positive gate voltage only.	The TRIAC can be triggered either by positive or negative gate voltage.
In SCR only one mode of operation is possible.	In TRIAC four different modes of operation is possible.
It is more reliable.	It is less reliable.
The SCR conduct current in one direction only.	The TRIAC conduct current in both the directions.
It needs two heat sink.	It needs only one heat sink.

### **12. Why IGBT is very popular nowadays?**

The main advantages of using IGBTs over other types of transistors are relatively fast switching speeds, a low driving power and a simple drive circuit due to the input MOS gate structure. It also offers a very low on-state voltage drop, due to conductivity modulation, and has superior on-state current density.

### **13. IGBT is a voltage-controlled device. Why**

An IGBT is a device that combines a MOSFET, a type of FET, in the front stage and a bipolar transistor in the rear stage. An IGBT operates in the same manner as an FET when it turns on. Therefore, an IGBT is also a voltage-driven device.

### **14. Recall the application of TRIAC**

The TRIAC (Triode for AC) is a semiconductor device that is commonly used in power regulation and switching applications. It is used in switching, phase control, chopper designs, brilliance control in lights, speed control in fans and motors, and so on.

### **15. What is the necessary of the coupling capacitor?**

It is used to block the c signal to the transistor amplifier. It allows ac & blocks the d c.

### **16. What is reverse saturation current?**

The current due to the minority carriers is called the reverse saturation current.

### **17. What is a FET?**

A field effect (FET) is a three terminal semiconductor device in which current conduction takes place by one type of carriers (either holes or electron) and is controlled by an electric field.

### **18. Why FET is called an unipolar device?**

The operation of FET depends upon the flow of majority carriers only (either holes or electrons) the FET is said to be unipolar device.

**19. What is meant by gate source threshold voltage of a FET?**

The voltage at which the channel is completely cut off and the drain current becomes zero is called as gate source threshold voltage.

**20. Why N channel FET's are preferred over P channel FET's?**

In N channel FET the charge carriers are the electrons which have a mobility of about  $1300 \text{ cm}^2/\text{VS}$ , whereas in P channel FET's the charge carriers are the holes which have a mobility of about  $500 \text{ cm}^2/\text{VS}$ . The current in a semiconductor is directly proportional to mobility. Therefore the current in N channel FET is more than that of P channel FET.

**21. What is JFET? And What are the terminals and types in JFET?**

JFET- Junction Field Effect Transistor. And the terminals are Gate, Drain and Source and the types are N- Channel JFET and P- Channel JFET.

**22. What are all the types of MOSFET?**

- i) Enhancement type
- ii) Depletion type

**23. Differentiate Enhancement and Depletion MOSFET.**

<b>Enhancement MOSFET</b>	<b>Depletion MOSFET</b>
Positive voltage at the gate	Negative voltage at the gate
Inversion layer is made	Depletion of majority carriers happens
Negative charges are formed	Positive charges are formed