NOORUL ISLAM COLLEGE OF ENGINEERING, KUMARACOIL

DEPARTMENT OF ELECTRICAL AND ELECTRONICS & ENGINEERING

ELECTRON DEVICES (EC 1211)

UNIT-I

1. **Define Electronics.**
   The branch of engineering which deals with conduction of current through vacuum or gas or a semiconductor.
2. **Define Semiconductor .**
   Semiconductor is a substance has its resistivity in between conductors and insulators. E.g. silicon, Germanium.
3. **Define Conductor**
   The substances, which allow electric current to pass through them, are called conductors. E.g. Copper.
4. **Define Insulator.**
   Material, which does not allow the passage of electric current through them.E.g. Glass, wood, etc.
5. **Define Energy band diagram**.
   It is diagram drawn between inter atomic spacing along the X-axis and the band energy along the Y-axis.
6. **What are free electrons?**
   The valence electrons, which are very loosely attached to the nucleus, are known as free electrons.
7. **Define doping.**
   The process of adding impurities to an intrinsic semiconductor is called doping.
8. **Define Intrinsic semiconductor**
   Semiconductor in an extremely pure form is called intrinsic semiconductor. Its valence shell must be tetravalent in nature.
9. **Define Extrinsic semiconductor**
   Semiconductor in an impure form is called extrinsic semiconductor. They are two types (i), P-type (ii), N-type.
10. **Define valence band.**
    The range of energy possessed by valence electron in an atom is called Valence band.
11. **Define Conduction band.**
    The range of energy possessed by conduction electron in an atom is called conduction band.
12. **Explain forbidden energy gap.**
    The separation between the conduction band and the valence band on the energy band diagram.

13. Define P-N junction.

When P-type and N-type are suitably joined together by the conducting surfaces of these two semiconductors is called P-N junction.

14 Define forward biasing.

When a diode is forward biased the current is produced because the holes in the P-region and electron from N-region moves towards the junction. The depletion region formed will be very small hence recombination occurs and current will be produced.

15. Define reverse biasing.

When a reverse biased voltage is given an electron from N-region and holes from P-region moves away from the junction,hence the depletion region formed is very high and hence a small current will be produced due to minority carriers.

16. Define reverse resistance.

The resistance offered by the diode in its reversed biased condition is called reverse resistance.

17. Define forward resistance

The resistance offered by the diode in its forward biased condition when a voltage is given is called forward resistance.

18. Define transition capacitance.

The P-N region on either of the dielectric media act as the plates hence we have components for making a plate capacitor the junction capacitance is called transition capacitance.

19. Define power rating.

The power rating of a diode is defined as the maximum value of power that can be dissipated without failure if V_f is the forward biased voltage and I_f is the forward biased current.

$$\mathbf{P_d = V_f \times I_f.}$$

20. Define diffusion capacitance.

This capacitance effect is present when the junction is forward biased it is called diffusion capacitance.

21. Define drift velocity and drift current.

When an electric field is applied the charge carriers moves in the opposite direction and produce current this result is drift current and net average velocity is called **drift velocity.**

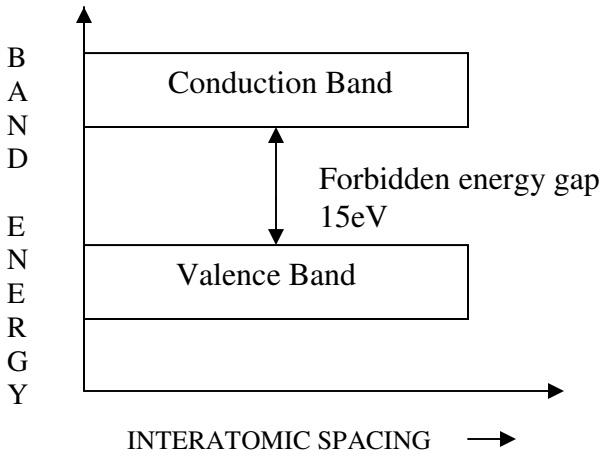
22. Define transition time.

Only after the minority carriers are swept of the junction the diode voltage begins to reverse and the diode current decreases exponentially the time which elapses between and when the diode normally recovered is the called **transition time.**

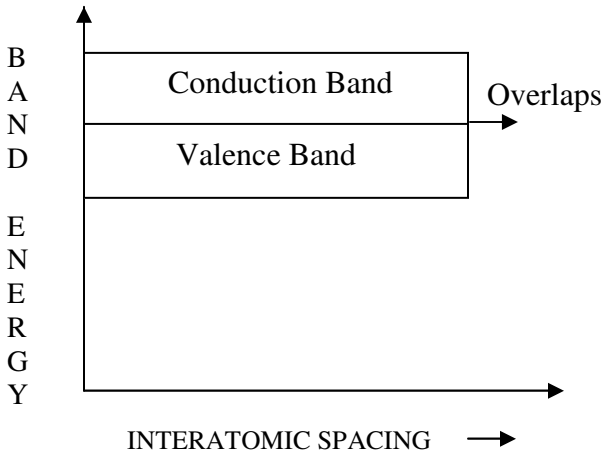
23. Define storage time.

When the conduction diode is reverse biased the voltage doesn't become zero. Immediately up to time t_1 the diode is conducting in the forward direction. The time interval $t = t_2 - t_1$ during which the stored minority carriers reduces to zero is called **storage time (t_s).**

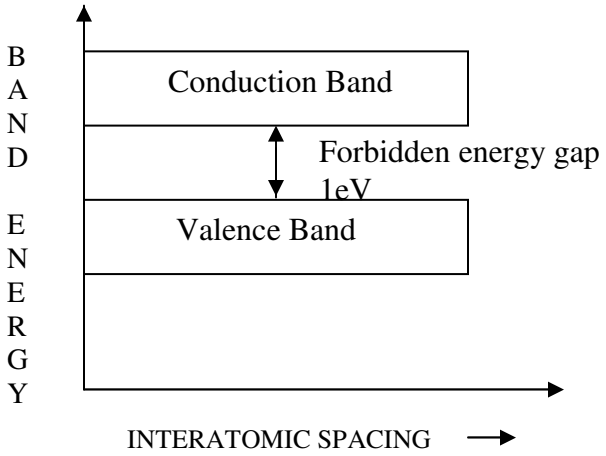
24. Draw the energy band diagram for Insulators



25. Draw the energy band diagram for Conductors



26. Draw the energy band diagram for Insulators



PART-B

1. Explain P-N diode biasing? Also explain VI characteristic?

   Refer notes.

2. Explain diode switching time?

   Refer notes.

3. Explain transition and diffusion capacitance?

   Refer notes.

4. Explain P-N diode current?

   Refer notes.

5. Derive continuity equation?

   Refer notes.

UNIT-III

1) What is a FET?

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

2) Which device is called as unipolar device? Why?

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

3) What are the main drawbacks in BJT?

i. The main two drawbacks in BJT are
ii. Low input impedance
iii. Considerable noise level.

4) What is pinch off voltage?

i. Drain source voltage above which the drain current become constant is known as pinch off voltage. The point N is called as pinch off point. Above the pinch off voltage the channel width becomes narrow and drain current remains constant.

5) What are advantages of FET?

i. It is a voltage control, constant current driven device that is the variation in input voltage controls the output current.
ii. The input impedance is very high so it allows a high degree of isolation between the input and the output circuit.
iii. The carriers are not crossing the junction hence the noise is highly reduced.
iv. It has a negative temperature co-efficient of resistance. This can avoid thermal runaway.

6) What are the two types of small signal model?

i. The small signal model is of two types
ii. Low frequency small signal model.
iii. High frequency small signal model.

7) Define transconductance?

a. It is the ratio of change in drain current to the change in gate source voltage at constant drain source voltage.

8) Define amplification factor?

i. It is the product of drain resistance and transconductance

9) State the two types of MOSFET. State also the modes in which they operate.

i. Types: (a) N- channel MOSFET, (b) P-channel MOSFET
ii. Depletion mode: In this mode the gate is maintained at positive potential with respect to source.
iii. Enhancement mode: In this mode both the gate and drain are maintained at positive potential with respect to source.

10) Why the input impedance of FET is more than that of a BJT?

i. The input impedance of FET is more than that of BJT because the input circuit of FET is reverse biased whereas the input circuit of BJT is forward biased.

11) What is MOSFET?

i. The MOSFET is an abbreviation for Metal Oxide Semiconductor Field Effect Transistor. It is a three terminal semiconductor device similar to FET with gate insulated from the channel.

12) Difference between FET and BJT

FET	BJT
1. It is a unipolar device.	1. It is a biopolar device
2. It is a voltage controlled device	2. It is a current driven device
3. Its input resistance is very high.	3. Its input resistance is very low.
4. It is less noisy.	4. It is comparatively more noisy.
5. No thermal runaway	5. There is thermal runaway
6. High switching speed	6. Lower switching speed.

13) Difference between MOSFET and FET

a. FET	MOSFET
1. Input impedance is of the order of 10	1. Input impedance is of the order or
2. It is operated only in depletion mode.	2. The depletion MOSFET can be operated in both depletion mode and enhancement mode.
3. Gate current is high.	3. Gate current is low.
4. High drain resistance.	4. Higher drain resistance.

14) Difference between UJT and BJT?

a. UJT	BJT
1. It has only one PN junction.	1. It has two PN junctions
2. The three terminals are labeled as Emitter(E), Base1 (B1) and Base2 (B2)	2. The three terminals are labeled as Emitter (E), Base (B) and Collector(C).
3. It has no ability to amplify signals.	3. It can amplify signals.

15) What is meant by negative resistance region of UJT?

i. In a UJT when the emitter voltage reaches the peak point voltage (Vp), emitter current starts flowing. After the peak point any effort to increase in emitter voltage (VE) further leads to sudden increase in the emitter current with corresponding decrease in VE, exhibiting negative resistance. This takes place until the valley point is reached. The region between the peak point and valley point is called “negative resistance region”.

16) Name the special features of a FET?

High input resistance
Low noise
Better thermal stability
High power gain
High frequency repose.

17) Define voltage variable resistance

i. FET can also be used in the region before pinch off. FET can also be used as a voltage control resistor. For this operation the drain to source resistance is controlled by the voltage VGS. Hence it is called as voltage variable resistor VBR.

18) The noise level in FET is very small. Why?

i. In FET, for current conduction no junction is involved . The conduction is either through an N- type or P-type semiconductor. Therefore, the noise level is very small.

UNIT-IV

1. **What is luminescence ?**

   Light can be emitted from a solid when it is stimulated by source of incident energy This is known as luminescence

2. **What is photo luminescence?**

   If the incident energy is in the form of photon then it is called photo luminescence

3. **What is electro luminescence?**

   If the radiation is produced by the application of an electric field then it is called as **electro luminescence**

4. **What is photo electric emission?**

   When a photon of light strike on the metal surface it may transfer enough energy to the electrons at the surface of the metal to escape from the surface this called as photo electric emission

5. **What is photo conductive effect?**

   It means that the conductivity of a semiconductor depends on light intensity falling on it

6. **What is photo voltaic effect ?**

   It mean that a voltage will appear across an open circuited PN junction when it is strike
   By radiation of photo diode

7. **What is dark current ?**
   When no light is applied in a photodiode there is a minimuim reverses leakage current called dark current.

8. **Application of photodiode?**
   They are used in optical communication system demodulators, encoders, light operated switches ,high speed counting.

9. **What is injection laser diode?**
   Laser diode which operate in a pulsed manner are termed as ILD

10. **What is continous wave laser diode?**
    The laser diode which produce a continous output are reffered to as CW
11. **application of laser diode**
    They are used in weld metals ,to guidance of industry machinery, optical fibre communication techniques.
12. **What is transmitted type?**
    In which both glass are transparent is that the light is scattered in the forward direction when the cell is activated
13. **what is reflective type?**
    In which it has a reflecting surface on one side of the glass sheet both these type of cell appear to be bright when activated under ambiend light condition

14. **Advantage of LCD**
    They are economical voltage required are small low power consumption

15. **what is photoconductive cell?**
    It is a semiconductor device whose resistance varies inversely with the intensity of light falls on it

16. **application of photoconductive**
    iIt is used inon/off circuit ,light measurement and light detecting circuit

17. **what is optocoupler?**
    It is an arrangement of coupling or isolating a light emitting source with a light dependent device through a transparent isolating medium
18. **What is optoisolator?**
    It offers electrical isolation between two circuits in a photocoupler is known as optoisolator
19. **application of optocoupler**
    it is used in logic circuits and also in level and position sensing circuit
20. **principle of photo resitivity**
    The resitivity of a semiconductor depends on the number of charge carries available in it when the semiconductor is not illuminated the number of charge carrier is less therefore the resitivity is high when the light in the form of photon strike the semi conductor each photon delivers energy to it hence the free mobile carriers are liberated and the resitivity is decreased

PART - B

1) EXPLAIN PHOTODIODE . DRAW THE Charcteristic of photodiode?
   Refer notebook
2) Explain solar cell along with diagram
   Refer notebook
3) Explain phototransistor and draw the characteristic
   Refer notebook
4) Explain laser diode along with the diagram
   Refer notebook
5) Explain LCD
   Refer note book
6) Explain LED
   Refer notebook
7) Explain photo resistor or photoconductive cell
   Refer notebook
8) Explain opto coupler
   Refer notebook
9) Explain seven segment display
   Refer notebook

UNIT-V

1.What is break over voltage?

The applied voltage at which the thyrister conducts heavily ,without gate voltage is called break over voltage.

2.What are the two conditions which turn on the SCR ?

- keeping the voltage vg=0 and applying the supplied voltage=0(or) > than the break over voltage.
- .By applying the positive voltage at the gate.

3.How the SCR can be switched off ?

To stop conduction reduce the supply voltage and make vg=0.thus it acts as a switch.

4.what are the advantages of SCR ?

- switching speed is high.
- It controls large current in the load by means of small gate current
- Since it has no moving parts it gives noiceless operation.

5. What are the applications of SCR ?

it is used for power control.
For high speed control of DC shunt motors.
As overlight detector.

6.What is a TRIAC ?

A TRIAC is a semiconductor switching device which can control alternating current in a circuit. it has three terminals namely main terminal1,main terminal 2 & gate.

7.What is a programmable unijunction transistor ?

A programmable unijunction transistor is a small thyrister. It can be used as a relaxation oscillator.

8.What is a varactor diode ?

Varactor diode is a junction diode with a small impurity dose at the junction.

9.What are the applications of varactor diode ?

- the varactor diode is oftenly used in tuning circuits.
- It finds use in parametric amplifiers.
- It is used in automatic frequency control device.
- It finds its application in adjustable bandpass filters.

10.Mention two applications of tunnel diodes ?

- it can be used as a microwave oscillator in the order of 10 giga hertz.
- It can be used in relaxation oscillator due to negative resistance property.

11.What is a transducer?

Transducer is a device which converts any one form of energy into electrical energy.

12.Name the classification of transducers ?

The transducers are classified into three types

- Resistive transducer
- Capacitive transducer
- Inductive transducer

13.Name the various types of thermistor ?

- Bead
- Probe
- Disc
- Rod

14.What are the applications of thermistor ?

- it is used for the measurement of temperature.
- It is used for the temperature compensation.
- It is used for control of temperature.

- Measurement of thermal conductivity.

15.Give the factors which cause the change of capacitance ?

- change in overlapping area ‘a’.
- change in distance ‘d’ detween the plates.
- Change in dielectric constant.

16.What are classifications of piezoelectrics materials ?

- Natural group
- Synthetic group

17.What is a zener diode ?

A zener diode is a special type of diode which are designed to operate in the break down region.

18.What is an LDR ?

Light dependent resistor are made from cadmium sulphide which absorbs light and hence its conductivity increases.

19.What are the advantages of charge coupled devices ?

They have a higher packing density and lower power dissipation,low voltage operation and higher transfer efficiency.

20.What are the applications of CCD ?

The CCD is used as high density memories, optical and infrared image sensors.

1.Explain in detail about SCR ?

(refer notes)

2.Writes brief notes on voractor diode ?

(refer notes)

3.With neat diagram explain thermistor ?

(refer notes)

4.With neat diagram explain zener diode ?

(refer notes)

5.With neat diagram explain LDR ?

(refer notes)