ST. ANNE'S
COLLEGE OF ENGINEERING AND TECHNOLOGY
(Approved by AICTE, New Delhi. Affiliated to Anna University, Chennai)
(An ISO 9001: 2015 Certified Institution)
ANGUCHETTYPALAYAM, PANRUTI – 607 106.

QUESTION BANK

PERIOD: JAN 2021 - MAY 2021 **BATCH:** 2020 – 2024

BRANCH: ECE **YEAR/SEM:** I/II

SUB CODE/NAME: EC8252 – ELECTRONIC DEVICES

UNIT-1
PART A

1. **What is meant by knee voltage?**
   Above 0.7v a slight increase in diode voltage provides a large increase in diode current. The voltage where the current starts increases rapidly is called the knee voltage.

2. **What is meant by peak inverse voltage? (April/May 2017)**
   PIV is the maximum reverse bias voltage which can be applied safely to diode without breaking down. Beyond this diode breakdown diode must be in peak inverse voltage rating that is higher than the maximum voltage that will be applied to them in a given application.

3. **What is meant by diffusion current? (May/June 2016)**
   A concentration gradient exists, if the number of either electrons or holes is greater in one region of a semiconductor as compared to the rest of the region. The holes and electron tend to move from region of higher concentration to the region of lower concentration. This process in called diffusion and the current produced due this movement is diffusion current.

4. **Define storage time. (May/June 2016)**
   The interval time for the stored minority charge to become zero is called storage time. It is represented as t s

5. **What is barrier potential? (Nov/Dec 2016)**
   Because of the oppositely charged ions present on both sides of PN junction an electric potential is established across the junction even without any external voltage source which is termed as barrier potential.

6. **Define Mass - action law. (Nov/Dec 2016) (May/June2014)**
   Under thermal equilibrium the product of free electron concentration(n) and free hole concentration(p) is constant regardless of magnitude

   $$np= ni^2$$

7. **What is the principal operation of PN Junction diode in reverse bias condition? (May/June 2014) (Apr/May 2019)**
   The majority of carriers are now pulled away from the edges of the depletion region. Therefore, the depletion region widens, and the potential barrier to the flow of majority carriers is increased. As a consequence, the diffusion current of majority carriers gets reduced. But the drift current almost remains unaffected. Because the minority carrier concentration on both sides of the

junction is low, only a small no of minority carriers can reach the boundaries of the depletion region. This result in a small reverse current in pn junction and tends to independent of the applied bias

8. What is diffusion capacitance? (Nov/dec2012)(Apr/May 2018)(Apr/May 2019)

The diffusion capacitance of a forward biased diode is defined as the rate of change of injected charge with voltage.

$CD = \tau I / ή VT$

Where

τ – time constant

I – current across the diode

VT – threshold voltage

9. Define avalanche breakdown? (May/Jun 2010)(Nov/Dec 2019)

When bias is applied , thermally generated carriers which are already present in the diode acquire` sufficient energy from the applied potential to produce new carriers by removing valence electron from their bonds. These newly generated additional carriers acquire more energy from the potential and they strike the lattice and create more number of free electrons and holes. This process goes on as long as bias is increased and the number of free carriers get multiplied. This process is termed as avalanche multiplication. Thus the break down which occur in the junction resulting in heavy flow of current is termed as avalanche break down.

10. Distinguish between intrinsic and extrinsic semiconductors. (May/June 2013)

Pure form of semiconductors are said to be intrinsic semiconductor.

Ex: germanium, silicon.

- It has poor conductivity
- If certain amount of impurity atom is added to intrinsic semiconductor the resulting semiconductor is Extrinsic or impure Semiconductor
- It has good conductivity.

11. Mention the two types of breakdown mechanism. (May/June 2013)

- Avalanche
- Zener
- Tunnelling

12. Define transition capacitance. (May/June 2009)

When a pn junction is reverse biased, the depletion layer acts like a dielectric material while p and n type regions on either side which has a low resistance act as the plates. In this way a reverse biased pn junction may be regarded as parallel plate capacitor and thus the capacitance across this set up is called transition capacitance

13. What are semiconductors?

The materials whose electrical property lies between those of conductors and insulators are known as Semiconductors. Ex germanium, silicon

14. Define drift current?

When an electric field is applied across the semiconductor, the holes move towards the negative terminal of the battery and electron move towards the positive terminal of the battery. This drift movement of charge carriers will result in a current termed as drift current.

15. Give the expression for drift current density.

$$Jp = q\ p\ \mu p\ E$$

Where, Jp - drift current density due to holes
q - Charge of holes
µp - Mobility of holes
E - applied electric field

16. Give the expression for diffusion current density(Nov/Dec 2019)

$$Jn = q\ Dn\ dn / dx$$

Where
Jn - diffusion current density due to electron
q - Charge of an electron
Dn – diffusion constant for electron
dn / dx – concentration gradient

17. Differentiate between drift and diffusion currents.

18. What is depletion region in PN junction?

The region around the junction from which the mobile charge carriers (electrons and holes) are depleted is called as depletion region.since this region has immobile ions, which are electrically charged , the depletion region is also known as space charge region

19. What is Reverse saturation current?

The current due to the minority carriers in reverse bias is said to be reverse saturation current. This current is independent of the value of the reverse bias voltage

20. What is the total current at the junction of PN junction diode?

The total in the junction is due to the hole current entering the n material and the electron current entering the p material. Total current is given by

I = Ipn(0) + Inp(0)
Where,
I – Total current
Ipn(0) - hole current entering the n material Inp(0) - electron current entering the p material

21. Give the diode current equation? (Apr/May 2018)

$I = I0. (e^{V / ή.V} -1)$

Where
I –total diode current
I0. - reverse saturation current V – Applied voltage
ή – Constant which is 1 for Germanium
and 2 for Silicon V V
T - voltage equivalent of temperature (T = T/11600)

22. Differentiate between drift and diffusion currents.

Drift current

i. It is developed due to potential gradient.

This phenomenon is found both in metals and semiconductors

Diffusion current

1. It is developed due to charge concentration gradient.

This phenomenon is found only in metals

23. What is recovery time? Give its types.

When a diode has its state changed from one type of bias to other a transient accompanies the diode response, i.e., the diode reaches steady state only after an interval of time " tr" called as recovery time. The recovery time can be divided in to two types such as
(i)forward recovery time (ii)reverse recovery time

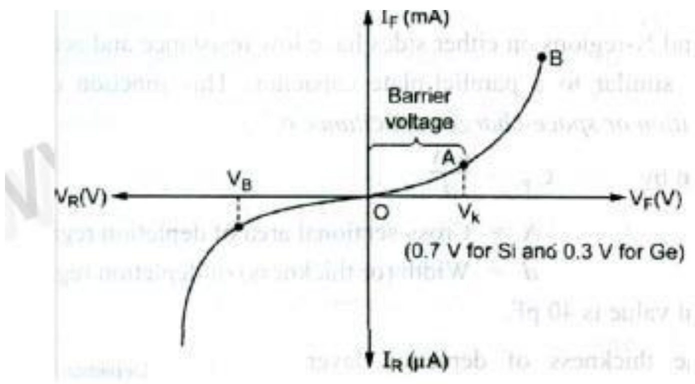
24. Define transition time.

The time when the diode has normally recovered and the diode reverse current reaches reverse saturaton current I0 is called as transition time. It is represented as t t

25. Define PIV.

Peak inverse voltage is the maximum reverse voltage that can be applied to the PN junction without damage to the junction.

26. Draw VI characterstics of PN diode



27. Write the application of PN diode.

- Can be used as rectifier in DC Power Supplies.
- In Demodulation or Detector Circuits.
- In clamping networks used as DC Restorers
- In clipping circuits used for waveform generation.
- As switches in digital logic circuits.
- In demodulation circuits.

PART-B

1. Derive an expression for PN junction diode forward and reverse currents with suitable diagram and necessary explanation. (16) **(April/May 2017) (Apr/May 2019)**
2. Briefly explain about depletion region and barrier voltage of a PN junction. (6) **(Nov/Dec 2015)**
3. With necessary diagram, describe the characteristics of a forward and reverse biased PN junction diode.(10)
4. Discuss about the switching characteristics of PN junction diode with suitable diagrams. **(April/May 2017) (Apr/May 2019)**
5. The diode current is 0.6 mA when the applied voltage is 400 mV and 20 mA when the applied voltage is 500 mV. Determine η. Assume kT/q = 25 mV. (16) **(May/June 2016)**
6. (i) Describe the action of PN junction diode under forward bias and reverse bias condition. (10) **(May/June 2016) (Nov/Dec 2019)**

   (ii) The reverse saturation of a silicon PN junction diode is 10 pi A. Calculate the diode current for the forward bias voltage of 0.6 V at 25 °C. (6)

7. Derive the current equation of PN Junction Diode. (16) **(Nov/Dec 2016) (Apr/May 2019)**

8. Describe construction of 'PN junction diode. Explain the- forward and reverse characteristic of PN junction diode and obtain its VI characteristic curve. (16) **(Nov/Dec 2016)**

9. Explain the theory of PN junction diode and derive its diode current equation. (16) **(May/June 2014)**

10. Explain and derive current component and switching characteristics of diode. (16)**(May/June 2014)**

11. Derive the PN diode current equation from the quantitative theory of diode Currents. (16) **(May/June 2012)**

12. Explain briefly the following
    a) Avalanche breakdown (4) **(Nov/Dec 2012) (Apr/May 2019)**
    b) Zener breakdown (4) **(Nov/Dec 2012) (Apr/May 2019)**

13. Explain the theory of PN junction diode along with its V-I characteristics

14. a) Discuss the effect of temperature upon the characteristics of PN junction diode (8) **(May/June 2013)**

    b)Distinguish between avalanche breakdown and zener breakdown.(8) **(May/June 2013)**

15. Derive the drift and diffusion current. (8) **(May/June 2009, Nov/Dec 2012)**

16. Explain the transition and diffusion capacitance**(Nov/Dec 2019)**

UNIT-2

PART-A

1. **Define early effect. (April/May 2017) (Apr/May 2018) (Apr/May 2019)**

A variation of the base-collector voltage results in a variation of the quasi-neutral width in the base. The gradient of the minority-carrier density in the base therefore changes, yielding an increased collector current as the collector-base current is increased. This effect is referred to as the Early effect.

2. **Why transistor is said to be current operated device. (April/May 2017) (Nov/Dec 2019)**

   The collector current is essentially independent of collector voltage and depends only upon the emitter current. Thus transistor is a current operated device where output current varies according to the input current

3. **What is tunneling phenomenon?**

   The phenomenon of penetration of the charge carriers directly though the potential barrier instead of climbing over it is called as tunneling.

4. **Compare between schottky diode and conventional diode.**

PN junction diode	Schottky diode
1. Here the contact is established between two Semiconductors	1. Here the contact is established between the semiconductor and metal
2. current conduction is due to both majority and minority carriers	2. current conduction is only due to majority carriers
3. large reverse recovery time	3. Small reverse recovery time
4. barrier potential is high about 0.7 V	4. Barrier potential is low about 0.25 V
5. switching speed is less	5. switching speed is high
6. cannot operate at high frequency	6. can operate at very high frequency (> 300MHz)

5. **Define input resistance with respect to CE configuration (May/June 2016)**

   Input resistance is low(1K ohm) compared to other configuration

6. **What is meant by base width modulation? (May/June 2016)**

7. **What is the need for biasing in the transistor? (May/June2014)**

   To use the transistor in any application it is necessary to provide sufficient voltage and current to operate the transistor. This is why biasing is needed

8. **Name the terminals of transistors(May/June2014)**

   - Emitter
   - Collector
   - Base

9. **What is "Early effect" in CB configuration and give its consequences? (Jun 2010, Nov/Dec 2015**

A variation of the base-collector voltage results in a variation of the quasi-neutral width in the base. The gradient of the minority-carrier density in the base therefore changes, yielding an increased collector current as the collector-base current is increased. This effect is referred to as the Early effect.

10. **Why CC configuration is used for impedance matching. (May/June 2013)**

The CC configuration is primarily used for impedance matching purpose, because the configuration has a high input impedance and low output impedance in contrast to that of the common base and common emitter configuration

11. **What is the reason for CE mode widely used transistor configuration?**

CE is most useful and widely used transistor configuration because it desirable to use the small base current rather than the large emitter current as the control quantity **(May/June 2009)**

12. **What is meant by punch through?**

For a very high value of V_{cb} ,the effective base width 'w' tends to zero, causing voltage breakdown in transistor. This phenomenon is called as punch through

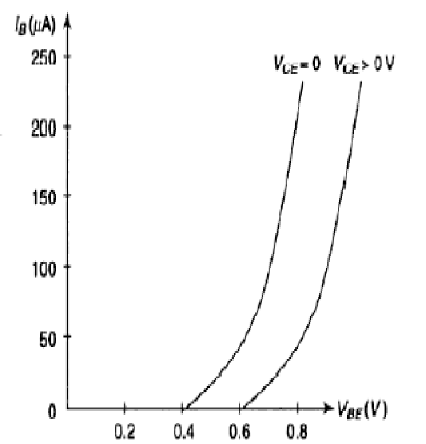
13. **Collector region of transistor is larger than emitter. Why?**

14. **Why is BJT is called current controlled device? (Apr/May 2018)**

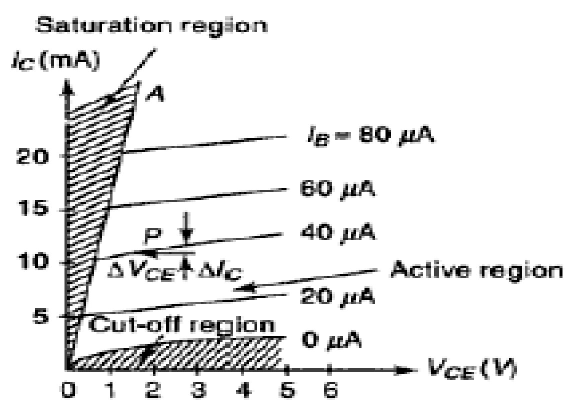
15. **Define Early Effect.**

A variation of the base-collector voltage results in a variation of the quasi-neutral width in the base. The gradient of the minority-carrier density in the base therefore changes, yielding an increased collector current as the collector-base current is increased. This effect is referred to as the Early effect.

16. **Draw the characteristics of CE configuration.**



CE input characteristics



CE output characteristics

17. **Among CE, CB, CC which one is most popular. Why?**

CE is most popular among the three because it has high gain compared to base and collector configuration. It has the gain about to 500 that finds excellent usage in audio frequency applications.

18. **Compare CE, CB, CC.**

Property	*CB*	*CE*	*CC*
Input resistance	Low (about 100 Ω)	Moderate (about 750 Ω)	High (about 750 kΩ)
Output resistance	High (about 450 kΩ)	Moderate (about 45 kΩ)	Low (about 25 Ω)
Current gain	1	High	High
Voltage gain	About 150	About 500	Less than 1
Phase shift between input & output voltages	0 or 360°	180°	0 or 360°
Applications	for high frequency circuits	for audio frequency circuits	for impedance matching

19. Why h parameter model is important for BJT(Apr/May 2019)

It is important because:

1. its values are used on specification sheets
2. it is one model that may be used to analyze circuit behavior
3. it may be used to form the basis of a more accurate transistor model

20. Define current amplification factor

In the CB configuration the current amplification factor, $\alpha = \frac{\Delta I_C}{\Delta I_E}$

In the CE configuration the current amplification factor, $\beta = \frac{\Delta I_C}{\Delta I_B}$

In the CC configuration the current amplification factor, $\gamma = \frac{\Delta I_E}{\Delta I_B}$

21. What do you meant by multi emitter transistor?

Transistor–transistor logic (**TTL**) is a class of digital circuits built from bipolar junction transistors (BJT) and resistors. It is called *transistor–transistor logic* because both the logic gating function (e.g., AND) and the amplifying function are performed by transistors.

TTL is notable for being a widespread integrated circuit (IC) family used in many applications such as computers, industrial controls, test equipment and instrumentation, consumer electronics, synthesizers, etc.

22. In a CR connection, the value of IE is 6.28 mA and the collector current Ic is 6.20 mA. Determine d.c. current gain.

Given: $I_E = 6.28$ mA and $I_C = 6.20$ mA

We know that common-base d.c. current gain,

$$\alpha = \frac{I_C}{I_E} = \frac{6.20 \times 10^{-3}}{6.28 \times 10^{-3}} = 0.987$$

23. The transistor has IE = 10 mA and α = 0.98. Find the value of base and collector currents.

Solution:

Given: $I_E = 10$ mA and $\alpha = 0.98$

The common-base d.c. current gain, $\alpha = \frac{I_C}{I_E}$

i.e. $0.98 = \frac{I_C}{10}$

Therefore $I_C = 0.98 \times 10 = 9.8$ mA

The emitter current $I_E = I_B + I_C$

i.e. $10 = I_B + 9.8$

Therefore, $I_B = 0.2$ mA

24. If a transistor has a α of 0.97 find the value of β. If β=200, find the value of α(Nov/Dec 2019)

Solution:

If $\alpha = 0.97, \beta = \frac{\alpha}{1-\alpha} = \frac{0.97}{1-0.97} = 32.33$

If $\beta = 200, \alpha = \frac{\beta}{\beta+1} = \frac{200}{200+1} = 0.995$

25. Give some applications of BJT

The BJT remains a device that excels in some applications, such as discrete circuit design, due to the very wide selection of BJT types available, and because of its high transconductance and output resistance compared to MOSFETs.

The BJT is also the choice for demanding analog circuits, especially for very-high- frequency applications, such as radio-frequency circuits for wireless systems.

Bipolar transistors can be combined with MOSFETs in an integrated circuit by using a BiCMOS process of wafer fabrication to create circuits that take advantage of the application strengths of both types of transistor.

PART-B

1. (i) Draw the Eber's Moll model for a PNP transistor and explain its significance. (8) **(Apr/May 2019)**
   ii) What is known as current amplification factor? Derive the relationship between the amplification factor of CE, CB and CC configuration. (8) **(April/May 2017)**
2. A transistor with $I_B = 100\ \mu A$, and $I_C = 2mA$. Find
   (i) β of the transistor
   (ii) α of the transistor
   (iii) Emitter current I_E
   (iv) If I_B changes by 25 μA and I_C changes by 0.6 mA. Find the new value of β. (10)

   Justify transistor as an amplifier. (6)
3. Draw the CE configuration of NPN transistor, and explain its input output characteristics with suitable diagrams. (16) **(May/June 2016)**

4. (i) The reverse leakage current of the transistor when connected in CB configuration is 0.2 mA and it is 18 IAA when same transistor is connected in CE configuration. Calculate fade & 13dc of the transistor. (Assume IB = 30 mA) (12) **(May/June 2016)**

   (ii)) Distinguish between h-parameter and hybrid it model. (4)

5. (i) With neat diagram explain about input and output characteristics of common emitter configuration. (8) (**Nov/Dec 2016)**

   (ii) Derive the h parameters for the CE. (8)

6. (i) Derive the expression of Gummel Poon model with a neat circuit diagram. (8) **(Nov/Dec 2016)**

   (i) Explain input and output characteristics of CB configuration. (8) **(Nov/Dec 2012) (Apr/May 2019)**

7. (i) Draw the h parameter equivalent circuit for NPN transistor CE circuit. Define and derive for all components.(12)

   (ii) Compare CB, CE and CC with respect to dc and ac parameters. (4)

8. Explain the characteristics of BJT in CC,CE,CB configuration and compare the performance of a transistor in different configurations (16) **(May/June 2014)**

9. Draw a voltage divider bias circuit and derive an expression for its stability factor (16**)(May/June 2014)**

10. (i) Draw the circuit for CE configuration of an NPN transistor and explain in brief is input and output characteristics. (10) **(Nov/Dec 2012)**

    (ii) Compare the performance of CE,CB, and CC configurations (6) **(Nov/Dec2012)**

11. Explain the input and output characteristics of a CE configuration with a neat sketch (16) **(Jun 2010)**

12. Draw and explain the characteristics of PNP transistor in CB configuration. (8) **(May/June 2013)**

13. Compare CB,CE and CC transistor configurations (8) **(May/June 2013)**

    (i) Explain the CE configuration of BJT in detail with required diagrams (10) **(May/June2009)(Nov/Dec 2019)**

(ii) Define and compare α,β & γ (6) **(May/June 2009)**

UNIT-3

PART-A

1. **Give the current voltage relationship of the D- MOSFET and E-MOSFET. (April/May2017)**

$$I_{DS}=I_{DSS}\{1-(V_{GS}/V_{GS(OFF)})\}^2$$

$$V_{GS}=0$$

2. **Compare MOSFET & FET. (May/June 2016) (Nov/Dec 2019)**

   1. In enhancement and depletion types of MOSFET, the transverse electric field induced across an insulating layer deposited on the semiconductor material controls the conductivity of the channel. In the JFET the transverse electric field across the reverse biased PN junction controls the conductivity of the channel.
   2. The gate leakage current in a MOSFET is of the order of 10^{-12} A. Hence the input resistance of a MOSFET is very high in the order of 10^{10} to 10^{15} Ω. The gate leakage current of a JFET is of the order of 10^{-9} A and its input resistance is of the order of 10^8 Ω.

Solution:

: MOSFET

If $\alpha = 0.97,\ \beta = \frac{\alpha}{1-\alpha} = \frac{0.97}{1-0.97} = 32.33$ higher than

: MOSFET

If $\beta = 200,\ \alpha = \frac{\beta}{\beta+1} = \frac{200}{200+1} = 0.995$

5. Comparing to JFET, MOSFETs are easier to fabricate.

3. **Give some applications of JFET. (May/June 2016)**

   1. FET is used as a buffer in measuring instruments, receivers since it has high input impedance and low output impedance.
   2. FETs are used in RF amplifiers in FM tuners and communication equipment for the low noise level.

1. FET operation depends only on the flow of majority carriers-holes for P-channel FETs and electrons for N-channel FETs. Therefore, they are called Unipolar devices. Bipolar transistor (BJT) operation depends on both minority and majority current carriers.
2. As FET has no junctions and the conduction is through an N-type or P-type semiconductor material, FET is less noisy than BJT.
3. As the input circuit of FET is reverse biased, FET exhibits a much higher input impedance (in the order of 100 M Ω) and lower output impedance and there will be a high degree of isolation between input and output. So, FET can act as an excellent buffer amplifier but the BJT has low input impedance because its input circuit is forward biased.
4. FET is a voltage controlled device, i.e. voltage at the input terminal controls the output current, whereas BJT is a current controlled device, i.e. the input current controls the output current.
5. FETs are much easier to fabricate and are particularly suitable for ICs because they occupy less space than BJTs.

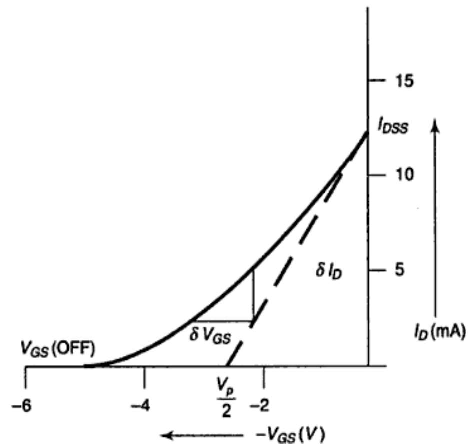
4. **What are the types of FET**
    - JFET
    - MOSFET
5. **List out the regions of operation for JFET**
    - Ohmic region
    - Cut-off region
    - Saturation region
    - Breakdown region
6. **In which region JFET act as a resistor and why? (May/June2014)**

    In ohmic region, JFET acts as resistor. The depletion layer of the channel is very small and the JFET acts as a variable resistor
7. **Differentiate between JFET and BJT. (May/June2014)**

    1. FET operation depends only on the flow of majority carriers-holes for P-channel FETs and electrons for N-channel FETs. Therefore, they are called Unipolar devices. Bipolar transistor (BJT) operation depends on both minority and majority current carriers.
    2. As FET has no junctions and the conduction is through an N-type or P-type semiconductor material, FET is less noisy than BJT.
    3. As the input circuit of FET is reverse biased, FET exhibits a much higher input impedance (in the order of 100 M Ω) and lower output impedance and there will be a high degree of isolation between input and output. So, FET can act as an excellent buffer amplifier but the BJT has low input impedance because its input circuit is forward biased.
    4. FET is a voltage controlled device, i.e. voltage at the input terminal controls the output current, whereas BJT is a current controlled device, i.e. the input current controls the output current.
    5. FETs are much easier to fabricate and are particularly suitable for ICs because they occupy less space than BJTs.

8. **When a FET act as a voltage variable resistor? (Nov/dec2012)**
9. **Distinguish clearly the difference between N with P channel FETs(Jun 2010)**
    a. In an N channel JFET the current carriers are electrons, whereas the current carriers are holes in a P channel JFET.
    b. Mobility of electrons is large in N channel JFET; Mobility of holes is poor in P channel JFET.
    c. The input noise is less in N channel JFET than that of P channel JFET.
    d. The transconductance is larger in N channel JFET than that of P channel JFET.

10. Write the equation for drain current of JFET. (May/June 2013)



11. Compare any four salient feature of BJT with JFET (May/June 2009) (Apr/May 2018)

FET	BJT
Low voltage gain	High voltage gain
High current gain	Low current gain
Fast switching time	Medium switching time
High output impedance	Low output impedance

12. Why it is called field effect transistor?

The drain current I_D of the transistor is controlled by the electric field that extends into the channel due to reverse biased voltage applied to the gate, hence this device has been given the name Field Effect Transistor.

13. Why FET is called voltage controlled device.

FET the value of the current depends upon the value of the voltage applied at the gate and drain. So it is *known as voltage controlled device*.

14. Define the term threshold voltage. (Apr/May 2019)

The **threshold voltage**, commonly abbreviated as $\mathbf{V_{th}}$, of a field-effect transistor(FET) is the value of the gate–source voltage when the conducting channel just begins to connect the source and drain contacts of the transistor, allowing significant current.The threshold voltage of a junction field-effect transistor is often called **pinch-off voltage** instead, which is somewhat confusing since "pinch off" for an insulated-gate field-effect transistor is used to refer to the channel pinching that leads to current saturation behaviour under high source–drain bias, even though the current is never off. The term "threshold voltage" is unambiguous and refers to the same concept in any field-effect transistor.

15. What is channel length modulation? (Nov/Dec 2019)

One of several short-channel effects in MOSFET scaling, **channel length modulation** (**CLM**) is a shortening of the length of the inverted channel region with increase in drain bias for large drain biases.As the drain voltage increases, its control over the current extends further toward the source, so the uninverted region expands toward the source, shortening the length of the channel region, the effect called *channel-length modulation*.

16. Compare N channel MOSFET with P channel MOSFET.

N-Channel MOSFET	*P-Channel MOSFET*
Saturation region ($V_{DS} > V_{DS}(\text{sat})$) $I_D = K_N(V_{GS} - V_{TN})^2$	Saturation region ($V_{SD} > V_{SD}$ (sat)) $I_D = K_P(V_{SG} + V_{TP})^2$
Non saturation region ($V_{DS} < V_{DS}(\text{sat})$) $I_D = K_N[2(V_{GS} - V_{TN})V_{DS} - V_{DS}^2]$	Non saturation region ($V_{SD} < V_{SD}(\text{sat})$) $I_D = K_P[2(V_{SG} + V_{TP})V_{SD} - V_{DS}^2]$
Transition point $V_{DS}(\text{sat}) = V_{GS} - V_{TN}$	Transition point $V_{SD}(\text{sat}) = V_{SG} + V_{TP}$
Enhancement mode $V_{TN} > 0$	Enhancement mode $V_{TP} < 0$
Depletion mode $V_{TN} < 0$	Depletion mode $V_{TP} > 0$

17. What is pinch off voltage?(Nov/Dec 2015) (Apr/May 2018) (Apr/May 2019)

The JFET is simply operating as a resistance whose value is controlled by Vgs. If we keep increasing Vgs in the negative direction , a value is reached at which the depletion region occupies the entire channel. At this value of Vgs the channel is completely depleted of charge carriers; the channel has in effect disappeared. This value of Vgs is therefore the threshold voltage of the device. For JFET threshold voltage is called as the pinch off voltage.

PART-B

1. (i) What is known as metal oxide semiconductor field effect transistor? Explain its principles of operation in enhancement mode with suitable diagram. (10) **(April/May 2017)**
   (ii) Discuss the effect of channel length modulation. (6) **(April/May 2017)**
2. Explain the construction and operation of N -Channel JFET with suitable diagram. (16) (**April/May 2017, Nov/Dec 2015) (Apr/May 2019) (Nov/Dec 2019)**
3. Derive an expression for drain current of FET in Pinch off region with necessary diagram. (16) **(May/June 2016) (Apr/May 2019)**
4. (i) Explain the construction and principle of operation of depletion MOSFET with suitable diagram. (10) **(May/June 2016) (Apr/May 2019)**
   (ii) Write short notes on Dual gate MOSFET. (6)
5. Describe the working and characteristics of MOSFET, D MOSFET and E MOSFET. (16) **(Nov/Dec 2016) (Apr/May 2019)**
6. (i) Write short notes on FINFET. (8**) (Nov/Dec 2016)**

(ii) Explain drain and transfer characteristic of JFET. (8)

7. (i) Discuss about FINFET and Dual Gate MOSFET (8) (**May/June 2014**)

   (ii) Explain the four distinct regions of the output characteristics of the JFET. (8) **(May/June 2014**

8. With the help of suitable diagram explain the working of different type of MOSFET. (10**) (May/June 2014)**
9. (i) Briefly describe some application of JFET. (6) **(May/June 2014)**

   (ii) Sketch and explain the construction of N-channel JFET. Give also its symbol. (4) **(Nov/Dec2012)**

10. With neat diagram explain the construction, working principle and V-I characteristics of p channel JPEG. (16**) (Nov/Dec 2012)**
11. With detail diagram explain the operation of depletion mode MOSFET and sketch the characteristics curves. (16) **(Nov/Dec 2012) (Nov/Dec 2019)**
12. Explain the operation of N-channel JFET. Sketch and explain the drain characteristics. (8) **(Nov/Dec2012)**
13. Define the following parameters of JFET (4) **(Nov/Dec 2012)**
    a. Trans conductance
    b. Drain resistance
    c. Amplification factor
    d. Power dissipation.
14. What is MOSFET? Explain the construction and working principle of enhancement mode and depletion mode MOSFET with a neat diagram (16) **Jun 2010)**
15. Describe the construction, operation and characteristics of N-channel JFET (8) **(May/June 2013)**
16. Draw the structure of N-channel depletion type MOSFET and explain its operation and characteristics (8) (**May/June 2**

UNIT-4

PART-A

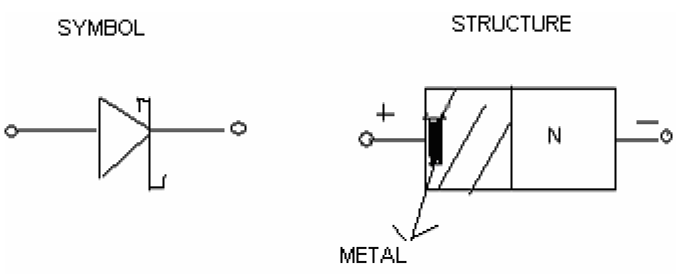
1. What is a metal semiconductor contact?

A metal semiconductor contact is a contact between a metal and a semiconductor which according to the doping level and requirement may act as a rectifying diode or just a simple contact between a semiconductor device and the outside world.

2. Define contact potential in metal semiconductor contact.

The difference of potential between the work function of metal and the work function of semiconductor in a metal semiconductor contact is termed as contact potential.

3. Give the symbol and structure of schottky diode.



4. Give the applications of schottky diode.

It can switch off faster than bipolar diodes
It is used to rectify very high frequency signals (>10 MHZ)
as a switching device in digital computers.
It is used in clipping and clamping circuits.
It is used in communication systems such as frequency mixers, modulators and detectors.

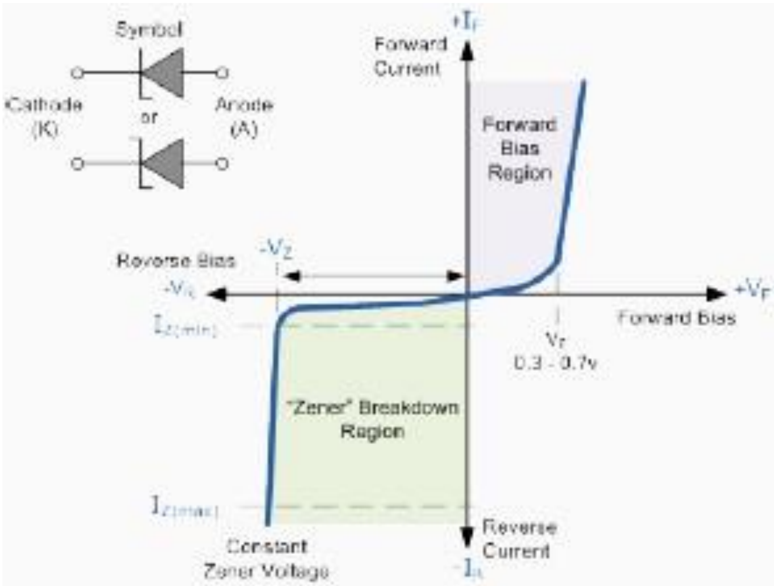
5. Compare between schottky diode and conventional diode.

PN junction diode	**Schottky diode**
1. Here the contact is established between two Semiconductors	1. Here the contact is established between the semiconductor and metal
2. current conduction is due to both majority and minority carriers	2. current conduction is only due to majority carriers
3. large reverse recovery time	3. Small reverse recovery time
4. barrier potential is high about 0.7 V	4. Barrier potential is low about 0.25 V
5. switching speed is less	5. switching speed is high
6. cannot operate at high frequency	6. can operate at very high frequency (> 300MHz)

6. Why zener diode is often preferred than PN diode.

When the reverse voltage reaches breakdown voltage in normal PN junction diode the current through the junction and the power dissipated at the junction will high. Such an operation is destructive and the diode gets damaged. Whereas diode can be designed with adequate power dissipation capabilities to operate in breakdown region. That diode is known as zener diode. It is heavily doped than ordinary diode.

7. Draw the V-I characteristics curve for zener diode.



8. What is zener breakdown?

Zener break down takes place when both sides of the junction are very heavily doped and Consequently the depletion layer is thin and consequently the depletion layer is tin. When a small value of reverse bias voltage is applied , a very strong electric field is set up across the thin depletion layer. This electric field is enough to break the covalent bonds. Now extremely large number of free charge carriers are produced which constitute the zener current. This process is known as zener break down.

9. Draw the energy band diagram of metal and semiconductor before and after conduction is made May/June 2016)/June2014)

10. List out the application of tunnel diode. (May/June2012)

- As logic memory storage device
- As microwave oscillator
- In relaxation oscillator circuit
- As an amplifier
- As an ultra-high speed switch

11. What is avalanche break down?

When bias is applied , thermally generated carriers which are already present in the diode acquire` sufficient energy from the applied potential to produce new carriers by removing valence electron from their bonds. These newly generated additional carriers acquire more energy from the potential and they strike the lattice and create more number of free electrons and holes. This process goes on as long as bias is increased and the number of free carriers get multiplied. This process is termed as avalanche multiplication. Thus the break down which occur in the junction resulting in heavy flow of current is termed as avalanche break down.

12. What is tunnelling phenomenon? (May/June2014) (Apr/May 2019)

The phenomenon of penetration of the charge carriers directly though the potential barrier instead of climbing over it is called as tunneling.

13. Give the advantages and disadvantages of tunnel diode

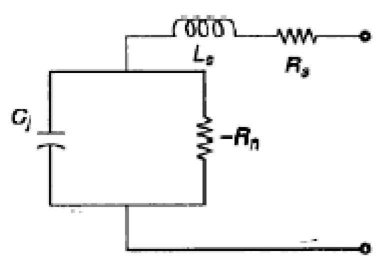
Advantages

- Low noise
- Ease of operation
- High speed
- Low power

Disadvantages

- Voltage range over which it can be operated is 1 V less.
- Being a two terminal device there is no isolation between the input and output circuit.

14. Draw equivalent circuit of tunnel diode(May/Jun 2010)



Equivalent circuit of tunnel diode

15. What is varactor diode?

A varactor diode is best explained as a variable capacitor. Think of the depletion region as a variable dielectric. The diode is placed in reverse bias. The dielectric is “adjusted” by reverse bias voltage changes.

- Junction capacitance is present in all reverse biased diodes because of the depletion region.
- Junction capacitance is optimized in a varactor diode and is used for high frequencies and switching applications.
- Varactor diodes are often used for electronic tuning applications in FM radios and television.

16. What is a LED?(May/Jun 2011)

A PN junction diode which emits light when forward biased is known as light emitting diode

17. Define Metal Semiconductor Junction(MSJ)

MSJ is the simplest type of charge separating junction. Metal to semiconductor junctions are of great importance since they are present in every semiconductor device. They can behave either as schottky barrier or as an ohmic contact.

18. Write the characteristics of varactor diode

- The diode conducts normally in the forward direction
- At relatively low voltage the reverse current saturates and then remains constant
- It is rising rapidly at avalanche point

19. Write the characteristics of Varactor diode

- The diode conducts normally in forward direction
- At relatively low voltage the reverse current saturates and then remains constant
- It is rising rapidly at avalanche point

20. What are breakdown diodes?

Diode which are designed with adequate power dissipation capabilities to operate in the break down region are called as break down or zener diodes.

21. What is a FinFET? (Apr/May 2018)

Fin type field transistors are substitutes for bulk CMOS at the nanoscale. FinFETs are double gate device. The two gates of the FinFET can either be shorted for higher performance or independently controlled for lower leakage or reduced transistor count. The FinFET offers many advantage in terms of IC processing that means it has been adopted as a major way forwards for incorporation within IC technology.

22. What is reffered to as CNTFET? (Apr/May 2018) (Nov/Dec 2019)

It is Carbon Nano Tube Field Transistor. It has a high drive and large transconductance. It is Classified based on geometry and operation.

PART-B

1. Draw the V -I characteristics of zener diode and explain its operation and also brief how it can be used as a regulator. (16) **(April/May 2017)**
2. Draw the V-1 characteristics of Schottky diode and explain its operation. (16) **(April/May 2017) (Apr/May 2019)**
3. What is meant by tunnelling? Explain the V-I characteristics of a tunnel diode using energy band diagram. (16) **(May/June 2016)**
4. Briefly describe about the operation of
   (i) Varactor Diode (8) (ii) Laser Diode (8) (**May/June 2016) (Nov/Dec 2019)**
5. (i) Explain the construction and volt ampere characteristics of tunnel diode. (8) **(Nov/Dec 2016)**
   (ii) Explain the working and characteristics of laser diode. (8)
6. (i) Explain V -I char of Zener diode. (8) (**Nov/Dec 2016)**(ii) Describe the VI characteristics of LDR. (8)
7. i) Draw the VI characteristics of zener diode and explain its operation(8)**(May/June 2014)**
   (ii) Write short notes on schottky diode (8) **(May/June 2014) (Nov/Dec 2019)**
8. (i) Explain the principal behind the varactor diode and list out its application (8) **(May/June 2014)**
   (ii) Give the details about the Laser diode (8) (May/June 2014)

9. What is tunneling? Describe the V-I characteristics of tunnel diode with application. **(Apr/May 2019)**

10. (i) With energy band diagram, explain the theory and characteristics of tunnel diode. (10) **(May/June 2013, Nov/Dec 2012)**

ii)Write notes on varactor diode(6) (**May/June 2013)**

11.Illustrate the operation of MESFET with energy band diagram**(Apr/May 2019) (Nov/Dec 2019)**

UNIT-5
PART-A

1. Give the various triggering devices for thyristor (April/May 2017)

- SCR
- UJT
- DIAC
- TRIAC

2. What are the types of thyristors (May/June 2016)

- Unidirectional thyristor
- Bidirectional thyristor
- Low power thyristor

3. Mention some advantages and disadvantages of LCD. (May/June 2016)

Advantages of LCD

- Low power is required
- Good contrast
- Low cost

Disadvantages of LCD

- Speed of operation is slow
- LCD occupy a large area
- LCD life span is quite small, when used on d.c.
- Therefore, they are used with a.c. suppliers.

4. Give some notes on CCD

A **charge-coupled device** (**CCD**) is a device for the movement of electrical charge, usually from within the device to an area where the charge can be manipulated, for example conversion into a digital value. This is achieved by "shifting" the signals between stages within the device one at a time. CCDs move charge between capacitive *bins* in the device, with the shift allowing for the transfer of charge between bins.The CCD is a major piece of technology in digital imaging. In a CCD image sensor, pixels are represented by p-doped MOS capacitors.

5. Name any two applications of photoconductive cell.

- Automatic ON and OFF of street light
- Bar code reading device
- Motion sensing lights and cameras
- Alarm system

6. Compare LED and LCD

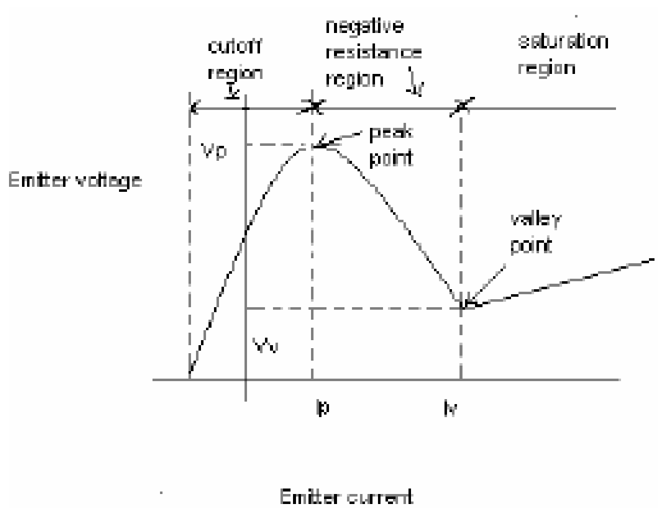
LEDs	LCDs
1. More power is required. 2. Fastest displays 3. More life. 4. LED is light source. 5. More temperature range. 6. Mounting is easy	1. Less power is required. 2. Slowest displays. 3. Less life. 4. LCD is not light source. It is a light reflector. 5. Less temperature range 6. Mounting is difficult.

7. What is intrinsic stand-off ratio? (Apr/May 2019)

If a voltage V_{BB} is applied between the bases with emitter open the circuit will behave as a potential divider. Thus the voltage V_{BB} will be divided across R_{B1} and R_{B2}

The resistance ratio $\eta = R_{B1} / R_{BB}$ is known as intrinsic stand -off ratio.

8. Give the V-I characteristics of UJT.

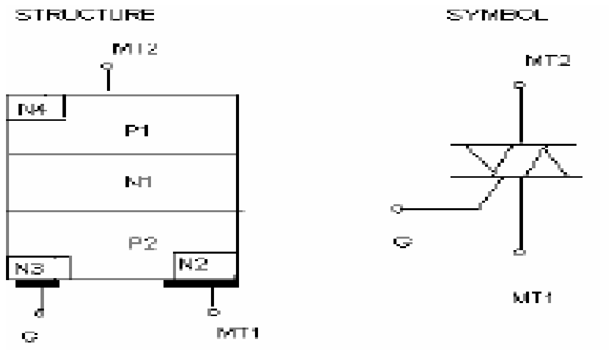


9. Mention the applications of UJT.

1. It is used in timing circuits
2. It is used in switching circuits
3. It is used in phase control circuits
4. It can be used as trigger device for SCR and triac.
5. It is used in saw tooth generator.
6. It is used for pulse generation

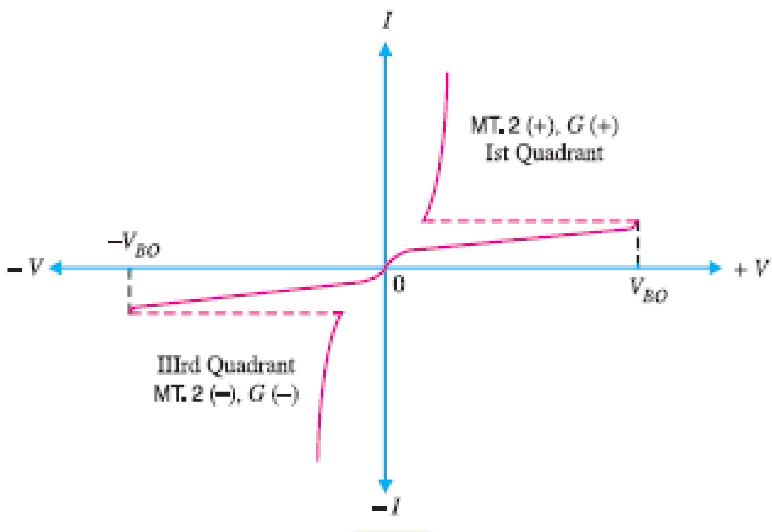
10. What is a TRIAC?(Apr/May 2018)

TRIAC is a three terminal bidirectional semiconductor switching device. It can conduct in both the directions for any desired period. In operation it is equivalent to two SCR's connected in antiparallel.



•

11. Draw the V-I characteristics for TRIAC.

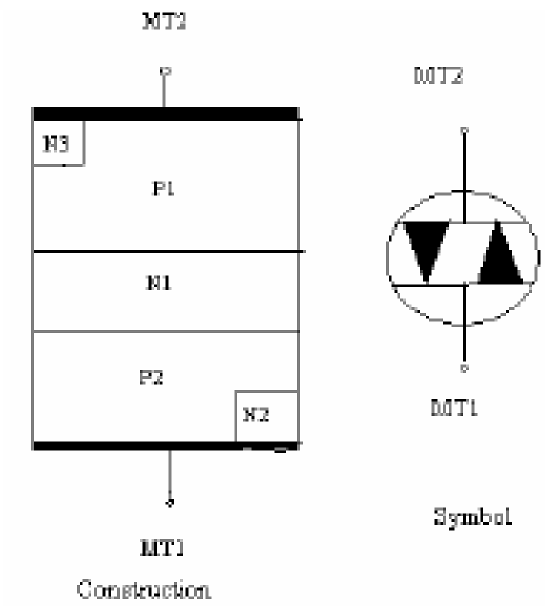


12. Give the application of TRIAC.

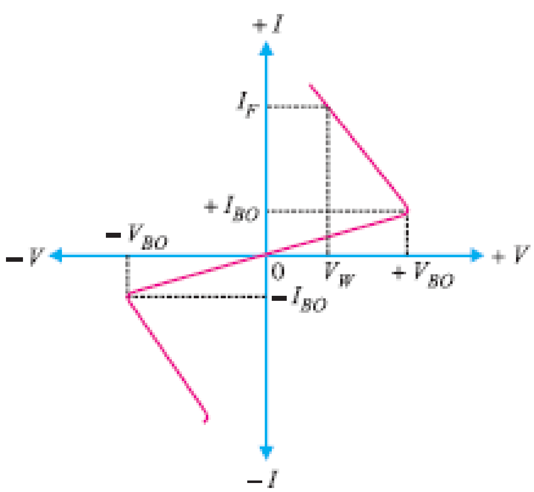
1.Heater control
2.Motor speed control
3.Phase control
4.Static switches

13. What is a DIAC? Give the basic construction and symbol of DIAC.

DIAC is a two terminal bidirectional semiconductor switching device. . It can conduct in either direction depending upon the polarity of the voltage applied across its main terminals. In operation DIAC is equivalent to two 4 layer diodes connected in antiparallel.



14. Draw the V-I curve for DIAC



15. Give some applications of DIAC.

- To trigger TRIAC
- Motor speed control
- Heat control
- Light dimmer circuits

16. Why SCR cannot be used as a bidirectional switch.

SCR can do conduction only when anode is positive with respect to cathode with proper gate current. Therefore, SCR operates only in one direction and cannot be used as bidirectional switch.

17. How turning on of SCR is done?

- By increasing the voltage across SCR above forward break over voltage.
- By applying a small positive voltage at gate.

- By rapidly increasing the anode to cathode voltage.
- By irradiating SCR with light.

18. How turning off of SCR is done?

- By reversing the polarity of anode to cathode voltage.
- By reducing the current through the SCR below holding current.
- By interrupting anode current by means of momentarily series or parallel switching

19. Define holding current in a SCR.

Holding current is defined as the minimum value of anode current to keep the SCR ON.

20. List the advantages of SCR.

- SCR can handle and control large currents.
- Its switching speed is very high
- It has no moving parts, therefore it gives noiseless operation.
- Its operating efficiency is high.

21. List the application of SCR. (Nov/Dec 2019)

- It can be used as a speed controller in DC and AC motors.
- It can be used as an inverter.
- It can be used as a converter
- It is used in battery chargers.
- It is used for phase control and heater control.
- It is used in light dimming control circuits

22. Compare SCR with TRIAC

SCR	TRIAC
1. unidirectional current	1. bidirectional current
2. triggered by positive pulse at gate	2. triggered by pulse of positive or negative at gate
3. fast turn off time	3,. Longer turn off time
4. large current ratings	4. lower current ratings

23.Differentiate BJT and UJT.

BJT	UJT
1. It has two PN junctions	1. It has only one PN junctions
2. three terminals present are emitter, base, collector	2. three terminals present are emitter, base1,base2
3. basically a amplifying device	3. basically a switching device

18. State the principle of operation of an LED (Apr/May 2019)

When a free electron from the higher energy level gets recombined with the hole, it gives the light output. Here in case of LEDs, the supply of higher level electrons is provided by the battery connection.

26.Give the advantages of LED(Nov/Dec 2019)

- They are small in size.
- Light in weight.
- Mechanically rugged.
- Low operating temperature.
- Switch on time is very small.
- Available in different colours.
- They have longer life compared to lamps
- Linearity is better.
- Compatible with ICs.
- Low cost.

19. State some disadvantages of LED(May/June 2016)

- Output power gets affected by the temperature radiation.
- Quantum efficiency is low.
- Gets damaged due to over –voltage and over-current.

20. List the applications of LED(May/June 2016)

- They are used in various types of displays.
- They are used as source in opto-couplers.
- Used in infrared remote controls.
- Used as indicator lamps.
- Used as indicators in measuring devices.

21. Give the application of TRIAC

- Heater control
- Motor speed control
- Phase control
- Static switches

22. What are the different operating modes of TRIAC?

- Keeping MT2 and G positive
- Keeping MT2 and G negative
- Keeping MT2 positive and G negative
- Keeping MT2 negative and G positive

23. What is the effect of temperature in solar cell?(Apr/May 2018)

The efficiency of solar cell decreases as it increases in temperature. Solar cells power tested at 25 degree Celsius and the temperature coefficient percentage illustrate charge in efficiency as it goes up or down by a degree.

PART-B

1. Draw the transistor model of an SCR and describe the working principle of an SCR with V -I characteristics. (16) **(April/May 2017) (Apr/May 2019) (Nov/Dec 2019)**
2. Write short notes on : (i) Opto coupler (8) **(April/May 2017)**
   (ii) LCD (8)
3. Draw the basic structure of UJT and explain V-I characteristics of UJT using equivalent circuit. (16) **(May/June 2016) (Nov/Dec 2019)**
4. Draw the V-I characteristics of (i) DIAC (ii) TRIAC and explain its operation. (16) (**May/June 2016)**
5. (i) Explain the operation and volt ampere characteristics of SCR. (8) (**Nov/Dec 2016)**
   (ii) Describe the working of photo transistor. (8)
6. (i) Explain the construction and operation of LCD. (10) **(Nov/Dec 2016)**
   (ii) Explain the working and characteristics of DMOS. (6)
7. Explain the operation, characteristics and application of SCR (16) **(May/June 2014)**
8. Write short notes on: (i) solar cell (8) (ii) CCD (8) **(May/June 2014)**
9. (i)Explain the construction, operation and characteristics of UJT (8) **(Nov/Dec 2012)**
   (ii) Sketch the symbol of DIAC and explain its operation and characteristics. (8) **Nov/Dec2012**
10. Explain the negative resistance characteristics of UJT with neat sketch (16) **(Jun 2010)**
11. (i) Describe the construction, operation and characteristics of UJT (8) **(May/June 2013, 2012)**
    (ii Discuss the operation and characteristics of photodiode. Mention the application of photodiodes and phototransistors. (8**) (May/June 2013)**
12. Explain the construction and operation of LCD. (16) **(May/June 2009)**
13. Draw and explain the two transistor equivalent model of SCR (10) (**May/June 2009, Nov/Dec 2012)**
14. Draw and explain the V-I characteristic of TRIAC. (6) **(May/June 2009)**

15. Outline the theory of light generation in Light emitting diode, with necessary expressions**(Apr/May 2019)**

.

.