UNIT-I – PN JUNCTION DIODE

1. Define Knee Voltage of a diode

The minimum voltage at which the diode starts conducting and current starts increasing Exponentially is called knee voltage of a diode.

2. What is peak inverse voltage

In reverse biased, opposite polarity voltage appears across diode. The maximum voltage which diode can withstand without breakdown is called peak inverse voltage.

3. Differentiate drift and diffusion current

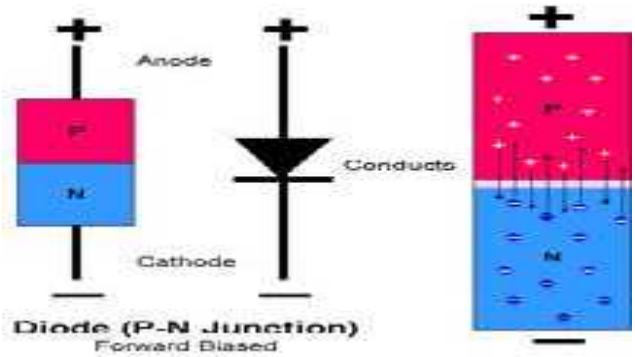
When a voltage is applied to a material, the free electrons move towards the positive of the battery.

While moving them collide with the adjacent atoms and keep changing their directions randomly.

In case of diffusion current, the external voltage is not required.

4. What is a PN Junction diode

There are two electrodes each from p-type and n-type materials and due to these two electrodes; the device is called a diode. It conducts only in one direction.



5. Compare series and shunt regulator

Shut regulator	**Series regulator**
1. The control element is in parallel With the load	The control element is in series with the load

2. Only small current passes through The control element, which is required To be diverted to keep output constant.	The entire load current is always passes through the control element.

6. What are the advantages of bridge rectifier over its centre tapped counterpart?

No centre tap is required in the transformer secondary. Hence, wherever possible a.c Voltage can be directly applied to the bridge.Due to pure alternating current in secondary of transformer, the transformer gets utilized effectively.

7. What is meant by dynamic resistance of diode

The resistance offered by the p-n junction diode under a.c condtions is called dynamic resistance of diode.

8. Differentiate between zener breakdown and avalanche breakdown.

	Zener Breakdown	**Avalanche Breakdown**
1.	The temperature coefficient is negative	The temperature coefficient is Positive
2.	This occurs for zener diodes with Vz less Than 6V	This occurs for zener diodes with Vz greater than 6V

9. Calculate the speed of electron when is falls by a potential of 300 k volts

Speed of electron V = $\frac{2Qv}{}$ m/s
Q = charge on electron = 1.6*10 c
M = mass of electron = 9.107*10 kg
V = 2*1.6*10*30010 = 324.8*10
9.107*10

10. What are the advantage and limitations of LCD Displays

-Less power consumption is the advantage of LCD displays. -
Poor reliability is the limitation of LCD Display.

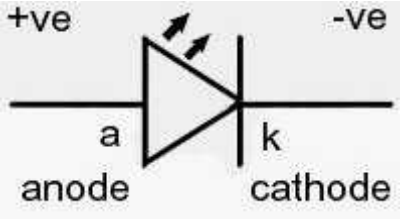
11. Define static and dynamic resistance of a PN diode.

The forward resistance of p-n junction diode when p-n junction is used in d.c Circuit and the applied forward voltage is d.c. is called static resistance

The resistance offered by the p-n junction diode under a.c. conditions is called dynamic Resistance of diode.

12. What is LED? Draw its symbol

LED is a light emitting diode which emits light when forward biased.



UNIT- I

PN- JUNCTION DEVICES

1. With a neat diagram explain the working of a PN Junction diode in forward bias and reverse bias and show the effect of temperature on its V-I characteristics. (16)

PN. Junction - when a piece of P-type semiconductor is suitably joined to a piece of N-type semiconductor, the contact surface formed is called PN Junction (J). (2)

a diagram (1).

Working of PN diode - formation of depletion layer in (3) PN Junction (under unbiased condition)

Diffusion across PN Junction

formation of Depletion Region

Existence of barrier potential

Forward bias: positive terminal - P-type diagram

④ Negative terminal - N type.

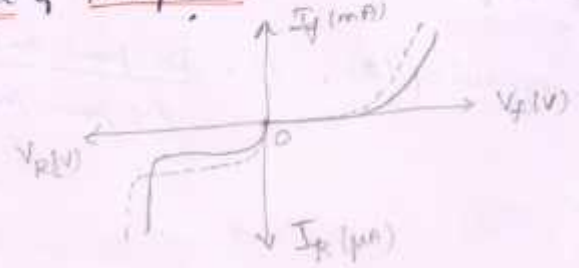
forward current. forward biasing

Reverse bias: positive terminal - N-type diagram

④ Negative " - P-type

No current. Reverse biasing

Effect of temperature on its V-I characteristics: (2)

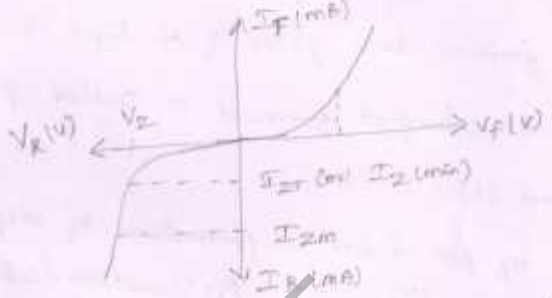


2) Explain the V-I characteristics of Zener diode. (8)

A properly doped crystal diode which has a sharp breakdown voltage is called zener diode (1)

* Zener voltage (1) * Zener current (1) * Zener biasing (1)
* Characteristics of zener diode. (1) diagram (1)

V-I characteristics of Zener diode (2):



3) Draw the circuit diagram and explain the working of full wave bridge rectifier and derive the expression for average output current and rectification efficiency (8)

Full wave bridge rectifier – four diodes which forms the four (1) arms of the bridge but it avoids the need for centre-tapped transformer.

* Circuit diagram (2) * output waveform (1)
* Both the half cycles, the direction of current flow through R_L is the same (1)
* Average output current (1) $I_{DC} = \frac{2I_m}{\pi}$, $I_{rms} = I_m/\sqrt{2}$
* Rectifier efficiency (2), $\eta = \frac{\text{DC power output}}{\text{AC power input}} = \frac{P_{dc}}{P_{ac}}$.

4. Explain the Operation of FWR with Centre tap transformer (6)
Also derive the following for this transformer dc output voltage (1), Dc output current (2) Rms output voltage (1)

* Centre tap transformer FWR – only 2 diodes are required for converting Single phase Ac supply into full wave pulsating DC. (2)
* diagram - circuit (2) * output waveform (2)
* Dc output voltage (1): $V_{dc} = \frac{2I_m R_L}{\pi}$
* Dc output current (2): $I_{rms} = I_m/\sqrt{2}$, $I_{dc} = \frac{1}{T}\int_0^T i(t)\,dt = \frac{2I_m}{\pi}$
* Rms output voltage (1): $V_{rms} = I_{rms} \cdot R_L$, $V_{rms} = V_m/\sqrt{2}$

5) Explain the following regulator circuits: (i) Transistorized shunt regulator (8) (ii) Zener diode shunt regulator (8)

Zener regulator (8):

In a breakdown region, the voltage of Zener diode is substantially constant for large change in current through it (2) * diagram (2)

* $I = I_L + I_Z$ (flows through current limiting resistor R_s)
* Input voltage $V_i = V_Z + (I_L + I_Z) R_s$ (1)
* Output voltage $V_{out} = V_Z = V_i - IR_s$ (1)
* Varying the load resistance R_L, varying the input voltage (2)
* $V_i \uparrow$, $R_s \uparrow$, $I_Z \downarrow$, Constant – output voltage.

Transistorized Shunt Regulator:

* Consists of zener diode (Vz) regulator along with transistor Q and resistor R_2. (1)
* Diagram (2)
* $V_{BE} \downarrow$, $I_Q \downarrow$
* Shunt regulator (1)
* Total current (1); $I = I_L + I_Q$.
* I/p voltage constant – output voltage ↓ (1)
* Load varyform finite min to max value (1)

6) Draw the circuit diagram & explain the operation of full wave rectifier using centretap & using bridge rectifier without centre tap transformer. Obtain the expression for peak inverse voltage. (16)

In FWR, both half cycles of the input AC supply are utilized.

Centre tapped FWR: (8)
* Diagram (2)
* Output waveform (2)
* Working (2)
* Peak inverse voltage (V_m) (2)

Bridge rectifier FWR (8)
* Diagram (2)
* Output waveform (2)
* Working (2)
* Peak inverse voltage (V_m) (2)

7) With neat diagram explain, construction & working of LED (8)

* Diagram (2). If the material is 'translescent' and if light energy released is visible (1)
* Selection of LED (1)
* LED voltage drop & current (1)
* Working of LED (2)