2 MARKS
EE2203 ELECTRONIC DEVICES AND CIRCUITS
UNIT 1

1. Define PN junction.
When a p type semiconductor is joined to a N type semiconductor the contact surface is called PN junction.

2. What is an ideal diode?
An ideal diode is one which offers zero resistance when forward biased and infinite resistance when reverse biased.

3. Compare ideal diode as a switch.
An ideal diode when forward biased is equivalent a closed (ON) switch and when reverse biased, it is equivalent to an open (OFF) switch.

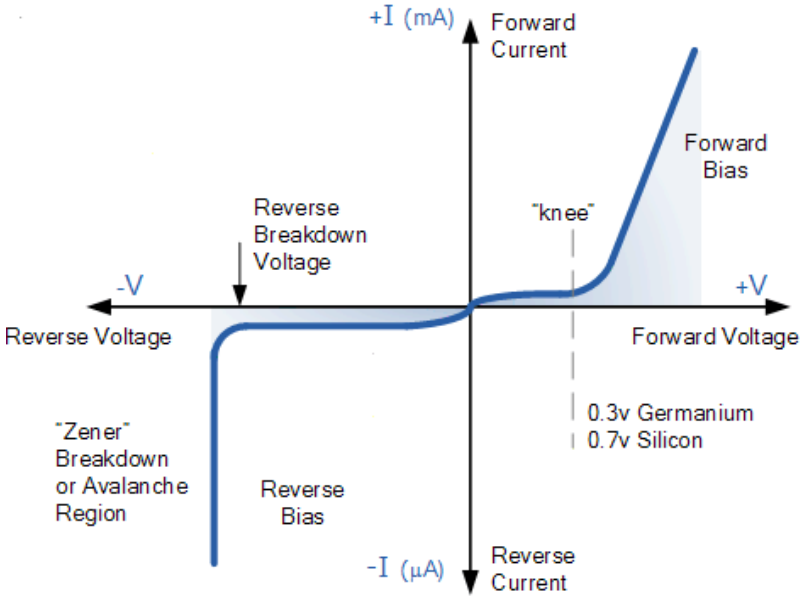
4. Explain the forward bias of diode (PN junction).
If anode is connected to positive terminal of the battery and, and cathode to Negative terminal of the battery, it is known as forward bias. Applied bias opposes the junction field; it will reduce the junction barrier and, therefore, aid current flow through the junction. Forward bias is equivalent to short circuit.

5. Explain reverse bias of diode (PN Junction).
If p type is connected to negative terminal and N type to positive terminal of the battery, it is reverse bias. At reverse bias, small current will flow in the range of micro amperes (10^{-6}A) called reverse saturation current. Reverse bias is equivalent to open circuit.

6. What is the effect of junction temperature on cut-in voltage of a PN diode?
Cut-in voltage of a PN diode decreases as junction temperature increases.

7. What is the effect of junction temperature on forward current and reverse current of a PN diode?
For the same forward voltage, the forward current of a PN diode increases and reverse saturation current increases with increase in junction temperature.

8. Draw the VI characteristics of PN junction diode.



9. A Germanium diode has a saturation current of 10 µA at 300°K. Find the saturation current at 400°K.

$I(\text{at } T_2) = I(\text{at } T_1) X 2^{(T2-T1)/10}$

$I_{300} = 10\mu A$ $T_1 = 300K$ $T_2 = 400K$

$I_{400} = I_{300} X\ 10^{-6} X\ 2^{10} = 10.2$ mA.

10. What is the difference between diffusion current and drift current?

Drift Current	**Diffusion current**
1. Developed due to potential gradient.	1. Developed due to charge concentration gradient.
2. Phenomenon found both in semiconductors and metals.	2. Only in semiconductors.

11. Define knee voltage(cut-in/threshold voltage)

It is the forward voltage applied across the PN diode below which practically no current flows. Above the knee voltage, current thorough the junction starts increasing rapidly.

12. Define breakdown voltage.

It is the reverse voltage of a PN junction diode at which the junction breaks down with sudden rise in the reverse current. Reverse current can only be limited by the external resistance in the circuit.

13. Differentiate avalanche and zener breakdowns.

Zener Breakdown	Avalanche Breakdown
1. Breakdown occurs due to heavily doped junction and applied strong electric field.	1. Breakdown occurs due to avalanche multiplication between thermally generated ions.
2. Doping level is high.	2. Doping level is low.
3. Breakdown occurs at lower voltage compared to avalanche breakdown.	3. Breakdown occurs at higher voltage.

14. Define reverse recovery time.

It is maximum time taken by the device to switch from ON to OFF stage.

15. Differentiate between breakdown voltage and PIV of a PN diode.

The breakdown voltage of a PN diode is the reverse voltage applied to it at which the PN junction breaks down with sudden rise in reverse current. Whereas, the peak inverse voltage (PIV) is the maximum reverse voltage that can be applied to the PN junction without damage to the junction.

16. 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.

17. Give the other names of depletion region?

i. space charge region
ii. Transition region

18. **What is barrier potential?**

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.

19. What is biasing?
Connecting the PN junction to an external voltage source for proper operation of the device is called biasing.

20. What is reverse saturation current?
The current due to the minority carriers during the reverse bias operation of the diode is called reverse saturation current. This current is independent of the value of the reverse bias voltage.

21. Define rectifier.
It is a device which converts alternating current into direct current.

22. Mention the type of rectifier circuits.
(i) Half wave rectifier
(ii) Full wave rectifier
    (a) centre tap rectifier
    (b) Bridge rectifier

23. List the advantages of full wave bridge rectifier.
1. Centre-tapped transformer is not needed.
2. For the same secondary voltage, the output is doubled than that of the centre-tap circuit.

24. Define Zener diode.
A zener diode is a heavily doped crystal diode which has a sharp breakdown voltage. If operated in the reverse breakdown region can serve as a voltage regulator.

25. Define ripple factor
The ripple factor is a measure of purity of the dc output of a rectifier and is defined as Rms value of component wave form/average or dc value.

26.Define rectifier efficiency.
The rectification efficiency tells us what percent of total input ac power is converted into useful dc output power. Thus rectification efficiency is defined as

$$\frac{\text{dc power delivered to load}}{\text{ac input power from transformer secondary}}$$

27. Compare between half wave and full wave rectifiers.

Parameter	*HWR*	*FWR-CT*	*FWR-bridge*
$V_{OUT\ DC}$	V_{max}/π	$2V_{max}/\pi$	$2V_{max}/\pi$
$V_{OUT\ RMS}$	$V_{max}/2$	$V_{max}/\sqrt{2}$	$V_{max}/\sqrt{2}$
PIV	V_{max}	$2V_{max}$	V_{max}
γ	1.21	0.48	0.48
η_{max}	40.6%	81.2%	81.2%
No. of diodes	1	2	4
PF	2	$\sqrt{2}$	$\sqrt{2}$
FF	1.57	1.11	1.11

28. Define voltage regulation

Voltage regulation is a measure of the ability of a rectifier to maintain a specified output voltage with the variation of load resistance and is defined as follows.

$$\text{voltage regulation} = \frac{\text{no load voltage -- full load voltage}}{\text{full load voltage}}$$

29. Compare FWR-CT and Bridge rectifier

Parameter	FWR-CT	Bridge rectifier
No. of Diodes	2	4
Requirement for centre tapped transformer	Yes	Not required
PIV rating	2 times V_{max}	V_{max}
η	81.2%	81.2%
TUF	0.693	0.813

30. Mention the applications of LEDs

- A very common application is in numeric displays indicating the numbers 0 through 9 using LED seven-segment display. By selecting different combinations of segments, a desired number can be produced. Displays of this type are found in calculators, digital meters, clocks, and wristwatches.
- Indicators and signs (traffic lights and signals, exit signs, emergency vehicle lighting etc.)

- With the development of high-efficiency and high-power LEDs, it has become possible to use LEDs in lighting and illumination.
- Latest technology TV and Computer Monitor display

31. List the applications of LCDs

- **Liquid Crystal Displays**

The most common application of liquid crystal technology is liquid crystal displays (LCDs.) Calculator and other displays.

Cell phones or similar personal communication devices

- **Liquid Crystal Thermometers**
- **Optical Imaging**

An application of liquid crystals that is only now being explored is optical imaging and recording.

- They are used for nondestructive mechanical testing of materials under stress.

32. Compare LED and LCD

LED	LCD
Consumes more Power In terms of milli watt	Consumes less power in terms of micro watts
Good brightness levels	Moderate brightness levels
Temp range -40 to 85˚C	-2 to 60˚C
Life time 1,00,000 hrs	50,000 hrs
Operating Voltage 1.5 to 5Vdc Response time 50 to 500 nano sec	Operating time 50 to 200ms Response time 50 to 200msec