Chapter review Questions:

1 Define Rectifier & state its use.
2 Explain P-type and N-type semiconductor junction .
3 Define PN junction Barrier voltage, depletion region, Junction Capacitance.
4 Draw Forward biased & reversed biased junction Diode
5 Draw symbol, circuit diagram for characteristics (Forward & reversed) Characteristics PN junction diode.
6 Define Forward voltage drop, Reversed saturation current, maximum forward current ,power dissipation Package view of diodes of different power ratings
7 Explain Construction (reference to doping level),Symbol ,circuit diagram for characteristics (forwarded & reversed) of Zener Diode
8 Explain Avalanche & Zener breakdown and its comparison.
9 Define Zener voltage, power dissipation, breaks over current, dynamic resistance & maximum reverse current.
10 Explain Construction ,Symbol ,circuit diagram for characteristics of Schottky diode
11 Explain Construction ,Symbol ,circuit diagram for characteristics of Tunnel diode
12 Define Optical Diodes
13 Explain Construction ,Symbol ,circuit diagram for characteristics of LED,
14 Explain IR LED & its working principle.
15 Explain Construction ,Symbol ,circuit diagram for characteristics of photodiode

Chapter-3 Rectifiers & Filters.

3.1 Rectifier: Definition- A semiconductor device which converts of an alternating current (AC) into direct current (DC **).**

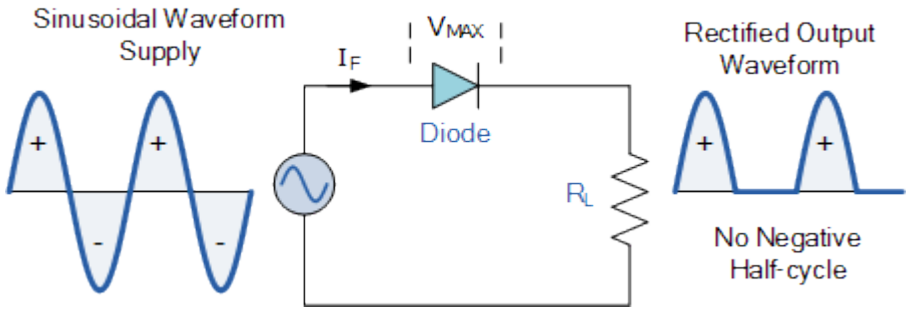
Example : Semiconductor Diode.

Need of Rectifier: To provide continuous voltage (DC Voltage) required to run almost all electronic devices & circuits.

3.1.1 Types of Rectifier : Half Wave Rectifier.

In this type the rectifier conducts current only during the + ve half cycles of the a.c. supply.

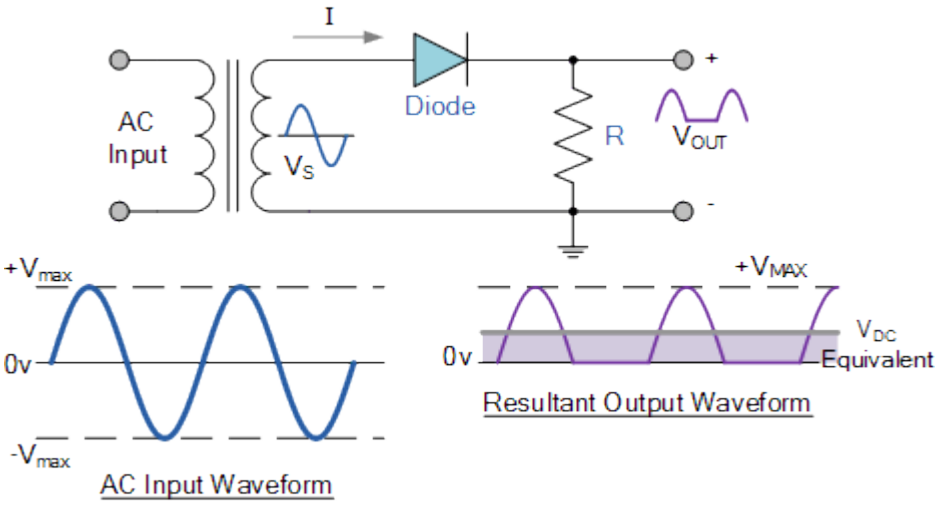
Simple Circuit:



Here – ve half cycles are suppressed i.e. during –ve half cycle no current passes through the diode hence no voltage appears across the load.

Max. rectifier Efficiency= Max. d.c.output power/ a.c. input power =40.6%

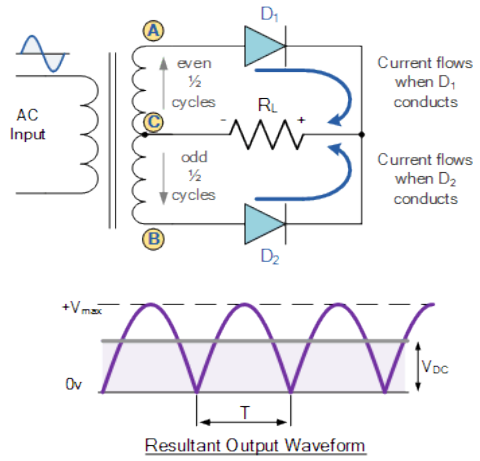
Schematic Diagram:



Full Wave Rectifier:

In this type , the rectifier utilises both half cycles of a.c. input voltage to produce the d.c output.

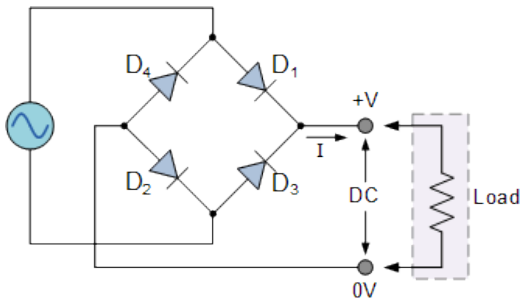
Full Wave Rectifier(Centre Tapped Type)



During the positive half cycle of the supply, diodeD1 conducts , while diodeD2 is reverse biased and the current flows through the load as shown .

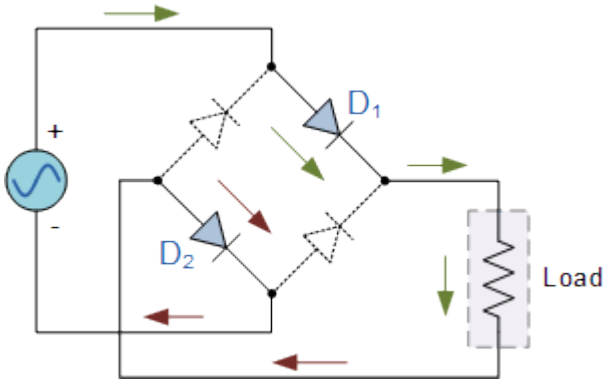
Similarly ,during the negative half cycle of the supply, diodeD2 conducts , while diodeD1 is reverse biased and the current flows through the load as shown .

Full Wave Rectifier(Bridge Type) : <u>The Diode Bridge Rectifier</u>



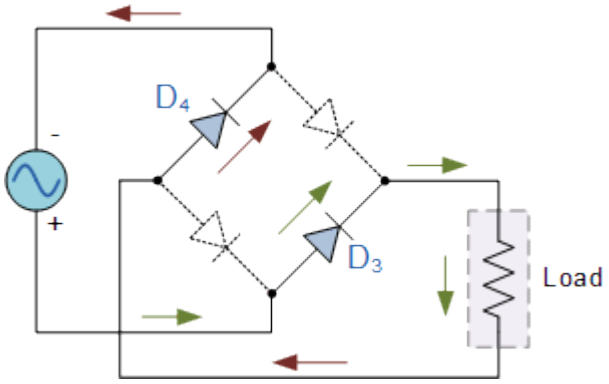
During the positive half cycle of the supply, diodes D1 and D2 conduct in series while diodes D3 and D4 are reverse biased and the current flows through the load as shown below.

The Positive Half-cycle



During the negative half cycle of the supply, diodes D3 and D4 conduct in series, but diodes D1 and D2 switch "OFF" as they are now reverse biased. The current flowing through the load is the same direction as before.

The Negative Half-cycle



Max. rectifier Efficiency= Max. d.c.output power/ a.c. input power=ή =81.2 %

3.1.2 Ripple: Ripple is the output of a rectifier that contains both dc & ac component.

Ripple Factor :The ratio of r.m.s value of ac component to the dc component in the rectifier output is known as ripple factor.

Ripple Factor= r.m.s value of ac component/ value of dc component.

For Half wave rectification ripple factor =1.21

For Full wave rectification ripple factor =.48

PIV (Peak Inverse Voltage) : It is the maximum reverse voltage that a diode can withstand without destroying the junction.

TUF(Transformer Utility Factor): Defined as the ratio of power delivered to the load to the ac rating of the transformer secondary.

TUF = dc power delivered to the load/ac rating of transformer secondary

$= P_{dc} / P_{ac.rated}$

$= P_{dc}/P_{in.rated}$

Rectifier Efficiency: The ration of dc power output to the applied input ac power is known as rectifier efficiency.

Rectifier Efficiency = dc power output / input ac power

3.1.3 Comparison of Three types of Rectifier.

Sl . No.	Particulars	Half wave	Centre-Tap FWR	Bridge FWR
1.	No. of Diodes	1	2	4
2.	Max. Efficiency	40.6%	81.2%	81.2%
3.	Ripple Factor	1.21	0.48	0.48
4.	Output Frequency	50Hz	100Hz	100Hz
5.	PIV(Peak Inverse Voltage)	Vm	2Vm	Vm

3.2 FILTERS:

Definition: A filter circuit is a device which removes the ac component (ripple) of rectifier output but allows the dc component to reach the load.

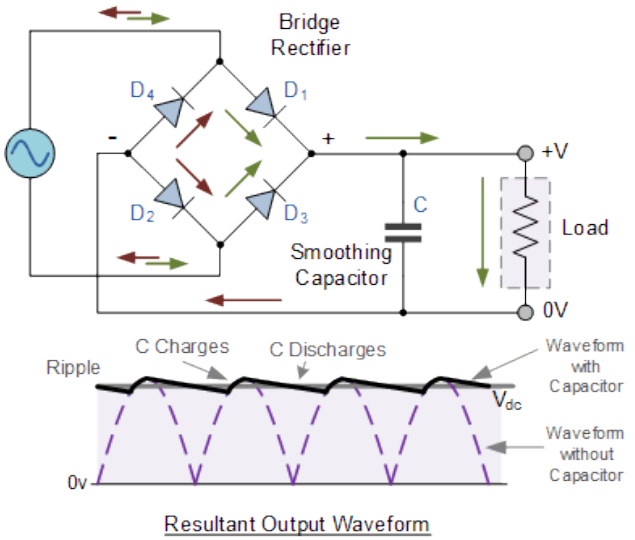
Need of Filter: To provide smooth DC output to the load.

Types of Filter:

i) Shunt Capacitor: It is also called Capacitor Filter. It offers low reactance to ac &a very high reactance to the dc component.

The capacitive reactance is $X_C=1/2\pi fc$,for d.c , f=0 Then, $X_C=\infty$

Hence a capacitor does not allow the d.c to pass through it.

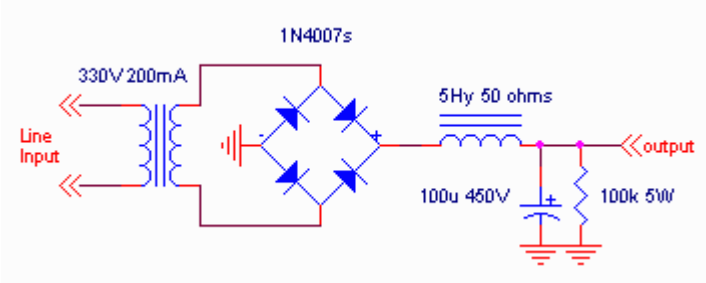


Resultant Output Waveform

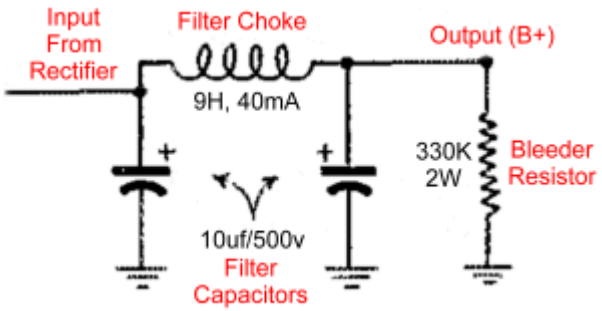
ii) Choke input filter :In this filter one inductor & one capacitor is used.

The inductive reactance is $X_L=2\pi fL$, for d.c , f(frequency)=0 Then, $X_L=0$, Hence inductor allows the d.c to pass through it.

It offers high reactance to the ac component but offers almost zero reactance to the dc component. That means it allows only dc component to flow through it.



iii) Capacitor input filter: It is also called π -Filter.



In this filter one inductor & two capacitors are used.

Here pulsating output from rectifier is applied across 1st capacitor which offers zero reactance to a.c& infinite reactance to d.c. Hence d.c component continues to reach across L(Choke Filter) .

The filter choke then allows the d.c component easily by blocking a.c component if any.

Finally the 2nd capacitor across load bypasses the a.c component if any which the choke(L) failed to block by making d.c component to reach across load.

Chapter Review Questions:

1. Define rectifier.
2. Draw the circuit of centre tap FWR & Bridge FWR.
3. State PIV of a diode.
4. Define TUF.
5. State the full wave rectifier efficiency.
6. Compare HWR &FWR.
7. Need of filter in power supply.
8. State different types of filters .
9. Define ripple & ripple factor.
10. Define rectifier efficiency.