- Electric Circuit: The closed path followed by an electric current.

$$I = \frac{dQ}{dt} \quad C/s \text{ or Amp}$$

$$P = \frac{dw}{dt}$$

- Electromotive Force: Voltage of an energy source.

$$V = \frac{dw}{dQ}$$

$$P = \frac{dw}{dQ} \cdot \frac{dQ}{dt} = VI$$

$$W = \int_{-\infty}^{t} P\,dt \quad J$$

⇒ Current entering +ve terminal → Absorbing
" leaving " " → Delivering

- Absorbing Power / Delivering Power

When the current is entering the +ve terminal then the element is absorbing power.
When the current is leaving the +ve terminal then the element is ~~leaving~~ delivering power.

1. Active Elements:
i. When an element is capable of delivering power independently for infinite time is active element

~~2. Passive E~~

ii. When an element is having property of internal amplification, it is an active element.

2. Passive Elements:
i. When an element is not capable of delivering energy independently then the element is called passive element.
Eg:- Resistor, Inductor, Capacitor, etc.

a. Resistor: current is directly proportional to applied voltage.

b. Capacitor : $i = C\frac{dV}{dt}$

c. Inductor: $V = L\frac{di}{dt}$

a. Resistor :

$J = \sigma E$ → Ohm's law 1st form

J → current density in amperes per square meter

σ ⇒ Conductivity of the substance which is constant for each particular substance.

E → Electric field along the conducting substance in volts per meter.

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$J = \frac{I}{A}$

$\frac{I}{A} = \frac{1}{\rho} \cdot \frac{V}{l}$

$\frac{I}{A} = \frac{V \cdot l}{RA\,l}$

$I = \frac{V}{R}$

$V = IR$ - Ohm's law 2nd form

$I = GV \rightarrow$ Ohm's Law 3rd form

$G = \frac{1}{R}$

$V = R\frac{dQ}{dt} \rightarrow$ Ohm's law 4th form

2. Capacitor:

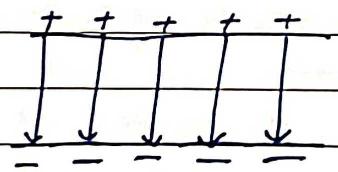

Fig: Electric field lines or lines of force b/w two charged conductor.

$E = \frac{F}{Q}$

Area of the plates as A and charge on the top plate be Q

Charge Density $= \frac{Q}{A}$

$$J = \frac{I}{A}$$

$$\frac{I}{A} = \frac{1}{\rho} \cdot \frac{V}{l}$$

$$\frac{I}{A} = \frac{V \cdot l}{R A l}$$

$$I = \frac{V}{R}$$

$V = IR$ - Ohm's law 2nd form

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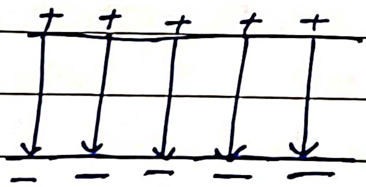

Fig: Electric field lines or lines of force b/w two charged conductors.

$$E = \frac{F}{Q}$$

Area of the plates as A and charge on the top plate be Q

Charge Density $= \frac{Q}{A}$

Acc. to Gauss's Law

$$Q = \oint D \cos\theta \, ds$$

$ds \rightarrow$ Increment of surface

$\theta \rightarrow$ Angle b/w D and ds.

D $\rightarrow$ Flux Density

$$Q = D.A$$

$$D = \varepsilon E$$

$$E = \frac{Q}{\varepsilon . A}$$

$$V = Ed$$

$$\boxed{V = \frac{Q}{\varepsilon A} d}$$

$$V = D \, Q$$

D $\rightarrow$ elastance $\rightarrow$ reciprocal of Capacitance

~~$V = \frac{Q}{}$~~

$$\boxed{V = \frac{Q}{C}} \Rightarrow \boxed{Q = CV}$$

$$\boxed{C = \frac{\varepsilon A}{d}}$$

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$$\frac{dq}{dt} = \frac{c\,dV}{dt}$$

$$\boxed{i = C\frac{dv}{dt} \qquad v = \frac{1}{C}\int_{-\infty}^{t} i\,dt}$$

$P = Vi$

$$\boxed{P = VC\frac{dv}{dt}}$$

$$W = \int P\,dt = \int VC\frac{dV}{dt}\cdot dt$$

$$W = \frac{1}{2}CV^2$$

* Linear & Non-Linear Resistors:
When the resistor follows ohm's law it is linear resistor & when the resistor doesn't follow ohm's law it is non-linear resistors.

⇒ Bidirectional → Independent of direction of current.

$$\frac{dq}{dt} = \frac{c\,dV}{dt}$$

$$\boxed{i = C\frac{dv}{dt} \qquad v = \frac{1}{C}\int_{-\infty}^{t} i\,dt}$$

$P = Vi$

$$\boxed{P = VC\frac{dV}{dt}}$$

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* Linear & Non-Linear Resistors:
When the resistor follows ohm's law it is linear resistor & when the resistor doesn't follow ohm's law it is non-linear resistors.

⇒ Bidirectional → Independent of direction of current.

$\Rightarrow$ When $C = 0$, $\frac{dV}{dt} = 0$
so $i = 0$] Steady state $\rightarrow$ Open Circuit

$\Rightarrow$ Capacitor doesn't allow sudden change in voltage.

$$i = C\frac{dV}{dt}$$

$dt \rightarrow 0$ for sudden change
$i \rightarrow \infty$ so it doesn't allow to change voltage suddenly

- **Linear Capacitor:**
When capacitance on the capacitor is independent on voltage magnitude then capacitor is called as linear capacitor.

- **Non-Linear Capacitor:**
When capacitance on the capacitor is dependent on voltage magnitude then capacitor is called as non-linear capacitor.

3. **Inductor:**

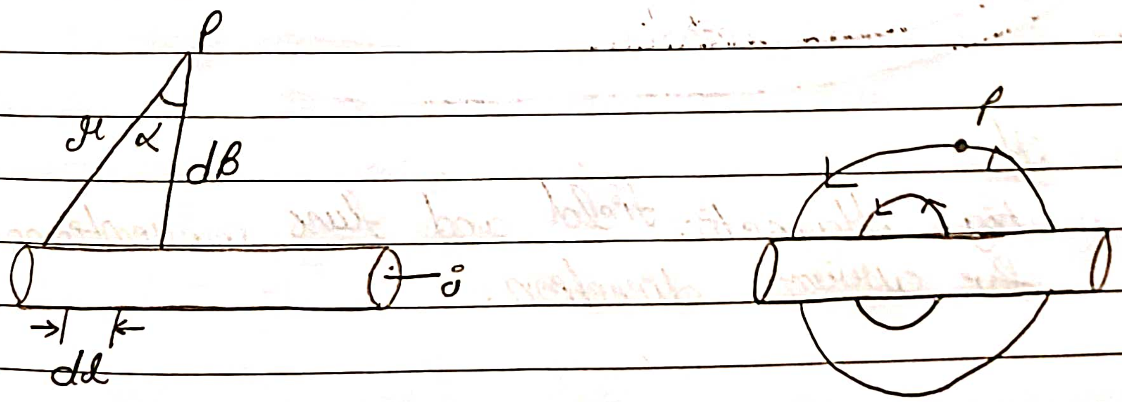

Fig: Identifying Quantities which determine the magnetic field at point P.

Force per unit magnetic pole:

$$dB = \frac{\mu i \cos\alpha \, dl}{4\pi r^2} \quad -(i)$$

μ = magnetic permeability

i = current

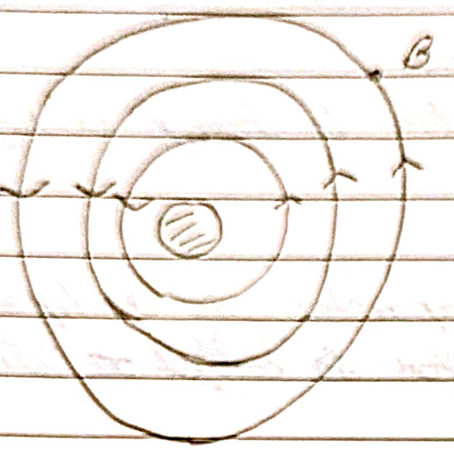

Fig: Cross-section of a current carrying inductor.

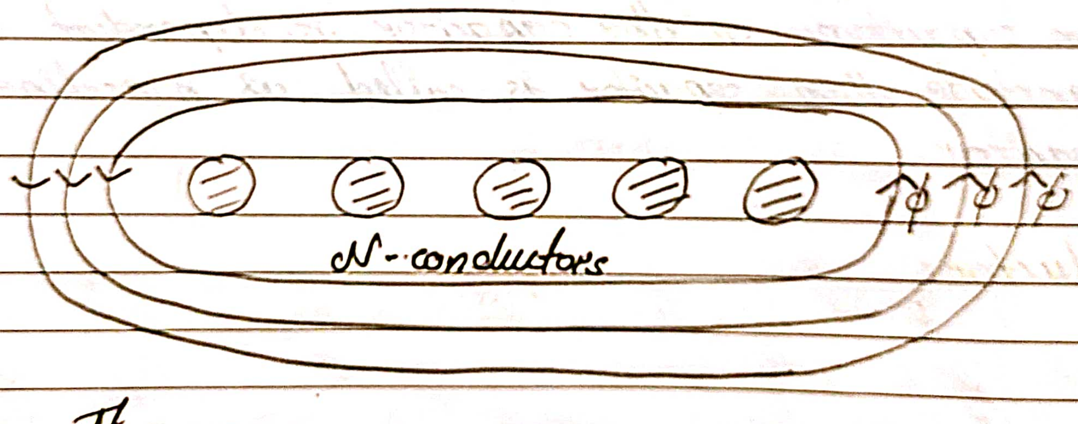

Fig: Magnetic field and flux conventions for current direction.

from (i)

* The magnetic field density from (i) is constant for a constant distance from the current carrying conductor.

The lines of magnetic field density by the lines of magnetic flux is given by

$$\phi = \int_{s} B\cos\theta \, ds \quad - (ii)$$

The total no. of flux linkage

$$\Psi = \sum_{j=1}^{N} N_j \phi_j \quad (iii)$$

~~N no of conductors when linked together in a magnetic field there'll be flux linkage.~~

flux linkage is the linking of the magnetic field with the conductors of a coil when the magnetic field passes through the loops of the coil, expressed as a value.

$$\Psi = N \int_{s} B\cos\theta \, ds \quad - (iv)$$

According to faraday's law

$$v = K \frac{d\Psi}{dt} \quad - (v)$$

$K = 1$

$$v = \frac{d\Psi}{dt} \quad - (vi)$$

$$\Psi = \int_{-\infty}^{t} v\,dt \quad - (vii)$$

$$q = \int_{-\infty}^{t} i\,dt \quad - (viii)$$

$$\Psi = \left[N \int \left(\int \frac{\mu \cos \theta \, dl}{4\pi r^2} \right) ds \right] i \quad \text{—(ix)}$$

Ψ and i are inductance parameters

$$\Psi = L i \quad \text{—(x)}$$

$L \rightarrow$ Self Inductance $\rightarrow$ Both Ψ and i have $\therefore$ same physical parameters

If current i_1 produces flux linkages Ψ_2 in another circuit the parameter is one of the mutual inductance.

$$\Psi_2 = M_{21} i_1 \quad \text{—(xi)}$$

Substitute (x) in (i)

So

$$v = \frac{d(Li)}{dt}$$

$$v = L\frac{di}{dt}$$

* We can't change current suddenly as $dt \rightarrow 0$

So $v = \frac{di}{dt}$

So $v \rightarrow \infty$

* In steady state, inductor is short circuit.

$dt \rightarrow \infty$

$v = 0$

Linear/ Non-Linear Inductance:
When the inductance of the inductor depends on the current magnitude, it is known as non-linear inductor.
when the inductance of the inductor doesn't depends on the current magnitude, it is known as linear inductor.

Types of Resistors:
Fixed Resistors
Variable Resistors.

Fixed resistor
↓
Molded carbon Composition resistor
→ (i) Carbon clay Composition
→ (ii) Metallized type
→ (iii) Wire Wounded resistor

A resistor has a colour band sequence yellow violet orange and gold. Find the range in which its value must lie so as to satisfy the manufacture's tolerance.

Yellow → 4
Violet → 7
Orange → 10^3
Gold → ±5

$(47 \times 10^3) \pm 5\%$
$= 44.65 \times 10^3 - 49.35 \times 10^3$
2350 Ω

- **Linear / Non-Linear Inductance:**

When the inductance of the inductor depends on the current magnitude, it is known as non-linear inductor.

when the inductance of the inductor doesn't depends on the current magnitude, it is known as linear inductor.

- **Types of Resistors:**

i) Fixed Resistors

ii) Variable Resistors.

Fixed resistor

↓

Molded carbon composition resistor

- (i) Carbon clay composition
- (ii) Metallized type
- (iii) Wire wounded resistor

Q. A resistor has a colour band sequence yellow violet orange and gold. Find the range in which its value must lie so as to satisfy the manufacturer's tolerance.

Ans. Yellow → 4

Violet → 7

Orange → 10^3

Gold → ±5

$(47 \times 10^3) \pm 5\%$

$= 44.65 \times 10^3 - 49.35 \times 10^3$

$2350\ \Omega$

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			1st - 2nd Band	3rd Band	4th Band
Bye	Bill	Black	0	10^0	Gold → ±5%
Bye	Brown	Brown	1	10^1	Silver → ±10%
Rosie	Realised	Red	2	10^2	No color (bare) = ±20%
off	only	Orange	3	10^3	
Soar	Yesterday	Yellow	4	10^4	
Go	Good	Green	5	10^5	
Bristol	Boys	Blue	6	10^6	
Via	Value	Violet	7	10^7	
Great	Good	Gray	8	10^8	
Western	Work	White	9	10^9	

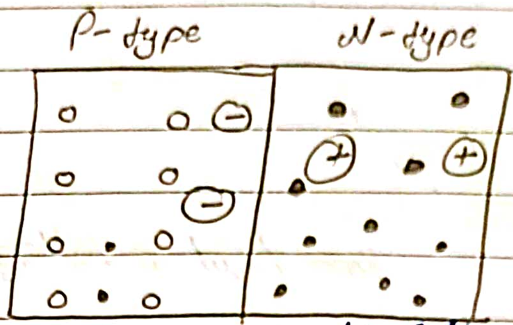
- Type of Capacitor: → offers low impedance to AC & very high imp. DC
  a Fixed Capacitor
  b Variable Capacitor

Capacitor is used to couple alternating voltage from one circuit to another circuit while at the same time blocking the DC voltage from reaching the next circuit. The capacitor is called as coupling capacitor or blocking capacitor or bypass capacitor.

Three types of fixed capacitors:
i MICA → 5 pF to 10,000 pF
ii Ceramic → 3pF to 2 uF
iii Electrolyte → more than both.

⇒ Capacitance colour code:
1st → Temp. Coefficient
2 →
3 → Significant Digits
4 →
5th → Tolerance

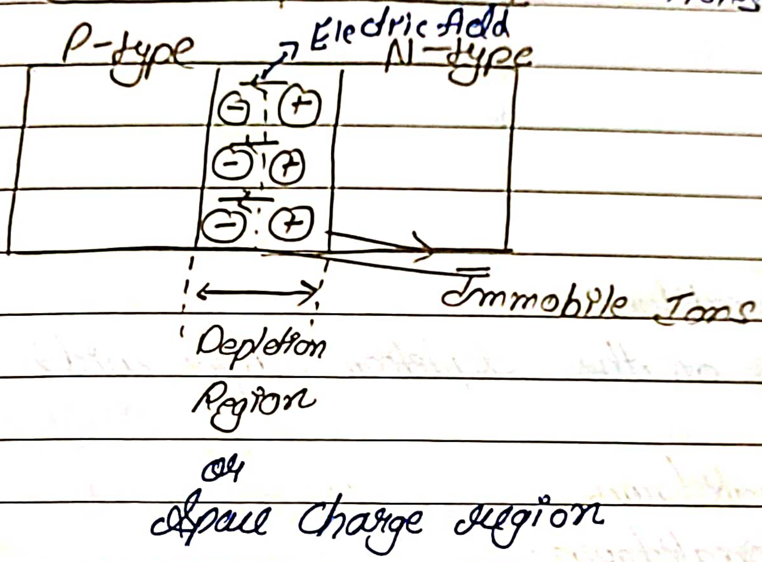
· PN Junction [No external voltage]



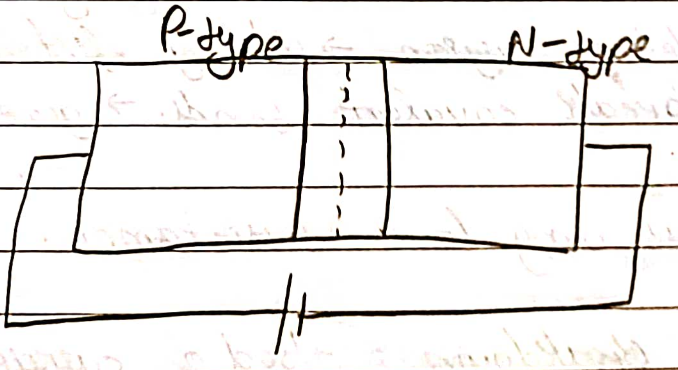
⊕ → +vely charged impurity ions

⊖ → -vely charged impurity ions

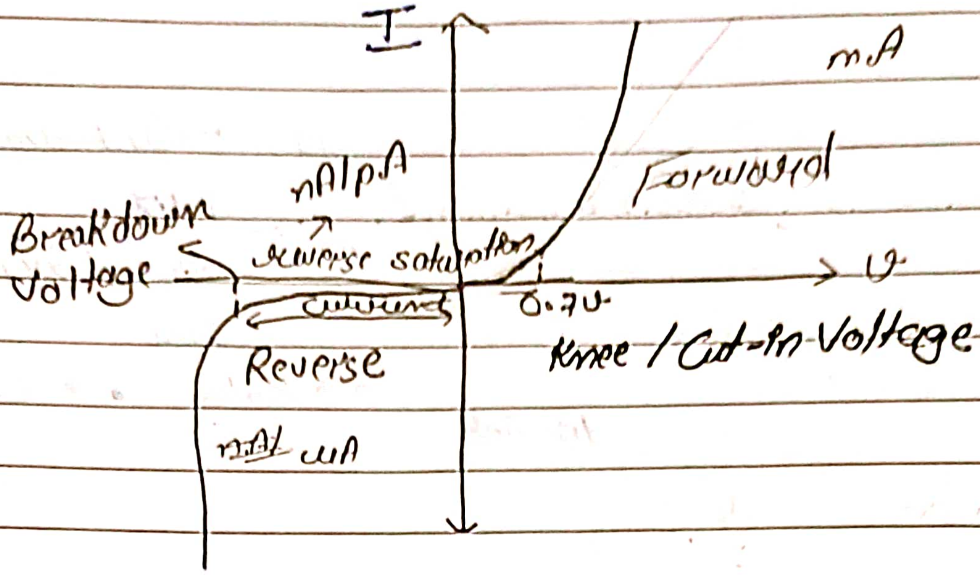
o → holes • → electrons



· Forward Bias - PN Junction



- I-V characteristics of a P-N junction diode:



- Junction Breakdown:

It depends on the depletion layer width and the doping label.

1. Zener Breakdown
2. Avalanche Breakdown.

1. Zener Breakdown:

It occurs when semiconductor is highly doped. & we have narrow depletion region → strong electric field → strong enough to break covalent bonds. → generate e- hole pair

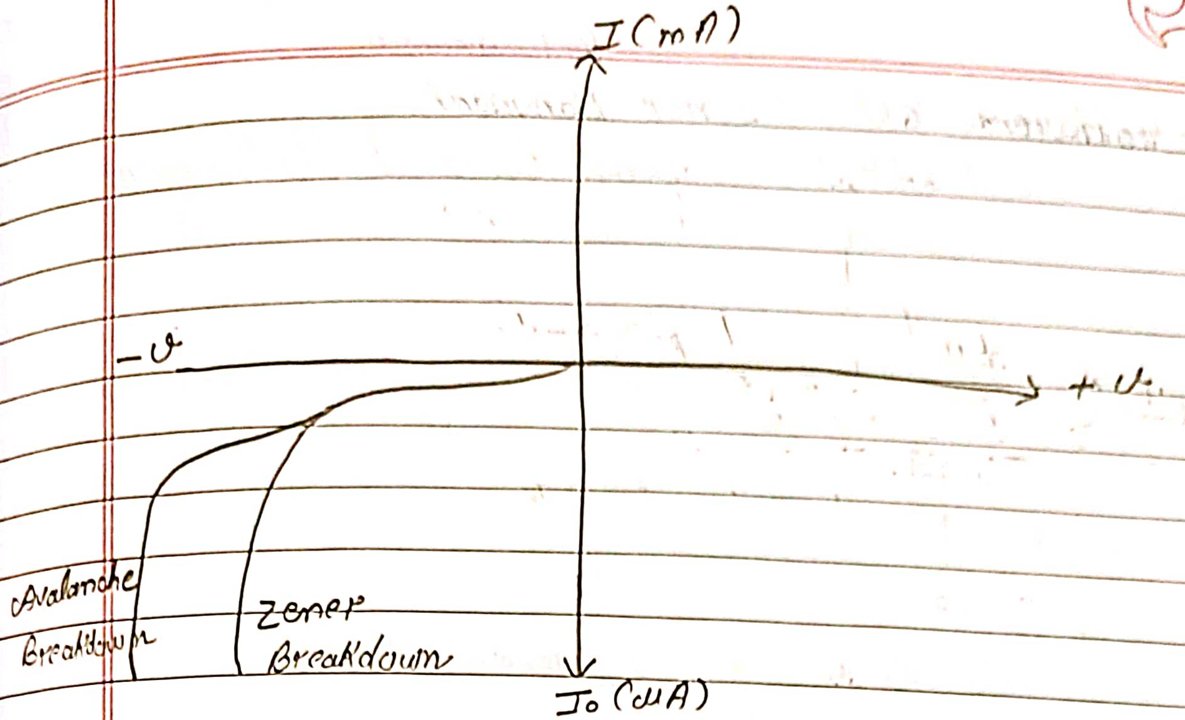
Junction has very low resistance.

2. Avalanche Breakdown : (flood of carriers)

Lightly doped → large depletion region → not strong $\vec{E}$ → can't break covalent bonds.

high energy ← increase v of minority carriers.

have ability to break covalent bonds → generate carriers accelerated by $\vec{E}$ → more collisions → more generation.



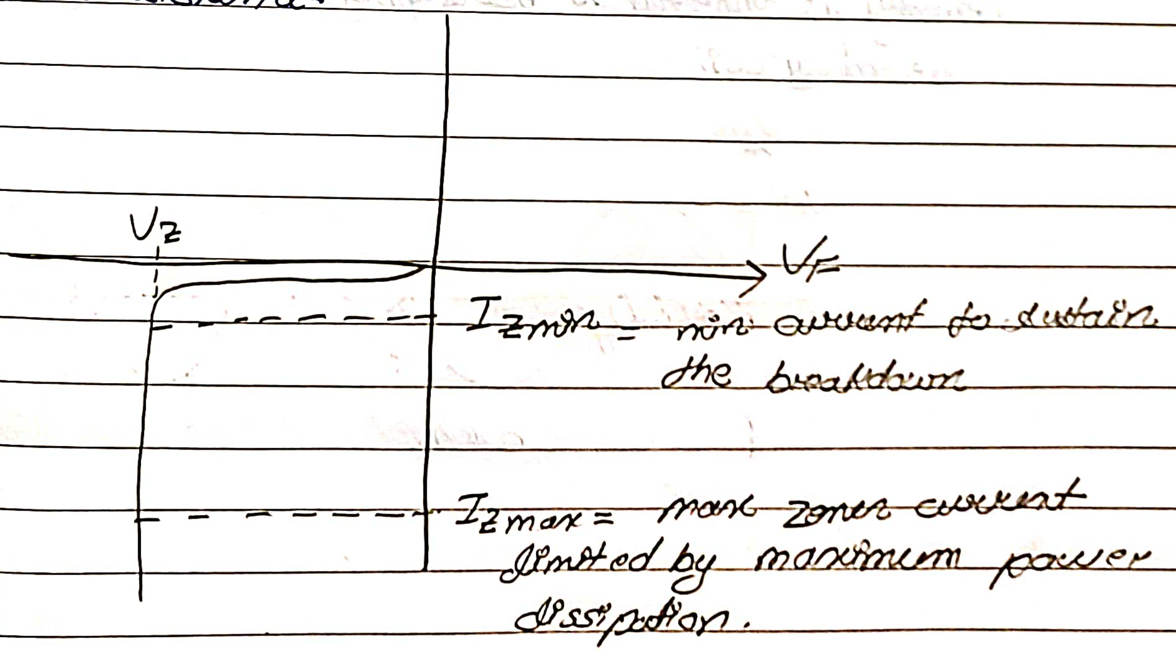
* Ideal diode can be said if it follows:

i When its forward biased it conducts with a resistance. (short circuit)

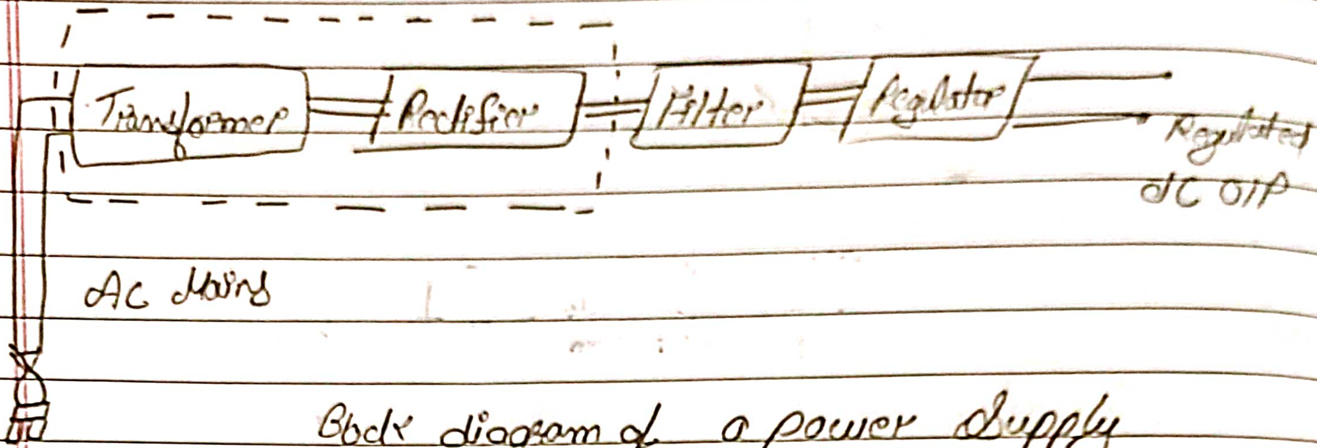
ii Infinite resistance when reverse biased → open circuit

• Zener Diode:

It is a reverse biased heavily doped silicon/germanium P-N junction diode which is operated in the breakdown region where the current is limited by both external resistance.



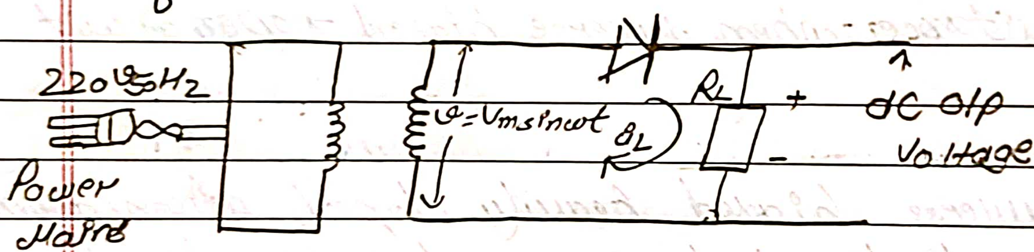
Reverse Voltage < 6V → Zener ~~Dominant~~ Predominance
> 6 V → Avalance ~~Dominant~~ Predominance

- 

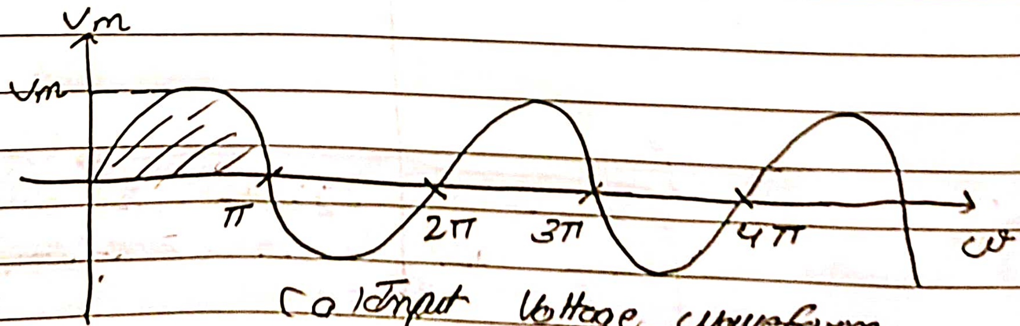
Block diagram of a power supply

- Rectifiers:

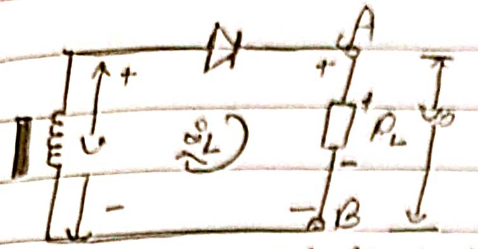
1. Half Wave Rectifier –



Primary is connected to ~~AC~~ power supply → induce current in secondary coil.

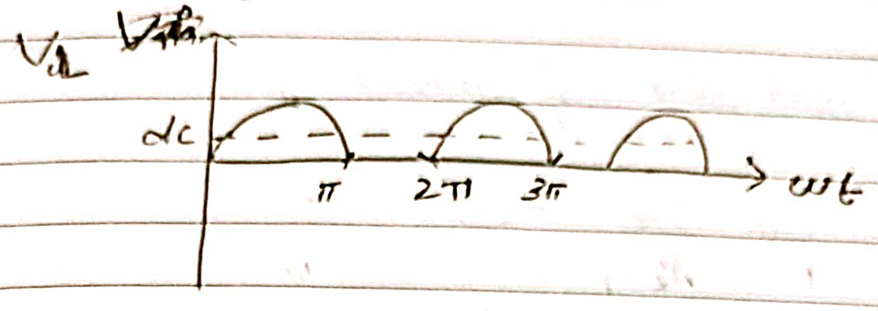


(a) Input Voltage waveform



(a) During +ve half cycle

Diode acts ~~as~~ forward bias → current flows → low resistance → very small voltage drop



During reverse bias → no current → no voltage → no graph / current.

- Peak Inverse Voltage:

It will be the maximum voltage ~~induced in secondary coil during reverse biased~~ in which the diode must withstand during the -ve half cycle of input.

$PIV = V_m$. ~~It says~~

- Output DC Voltage

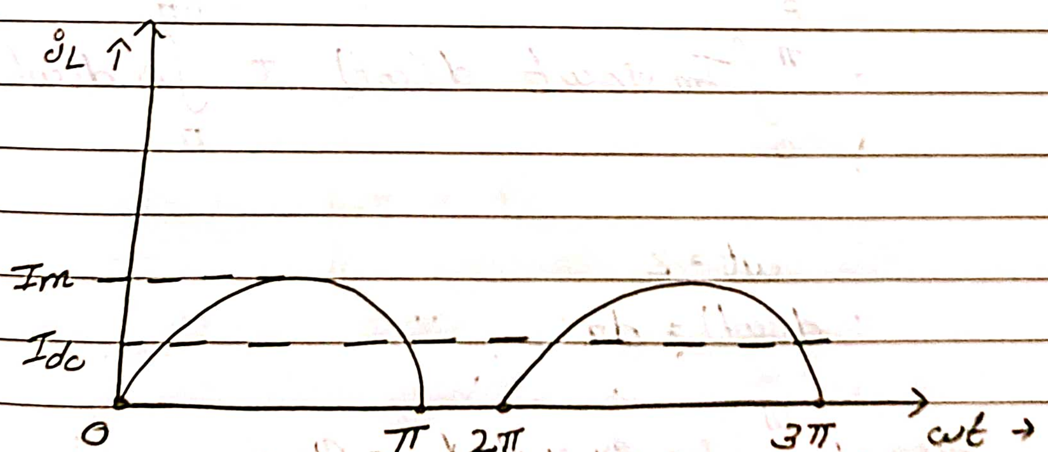


Fig: Waveform of current flowing through R_L in a half wave Rectifier.

$i_L = I_m \sin \omega t$ — (1)

for $0 \le \omega t \le \pi$

$i_L = 0$

for $\pi \le \omega t \le 2\pi$

I_m = peak value of current i_L.

$$I_m = \frac{V_m}{R_L} \quad -(2)$$

To find the dc or average value of current, we can find the net area under the curve over one complete cycle i.e. for 0 to 2π and divide this area by the base i.e. 2π.

we first integrate & then use eqn. (1) and to find the area.

$$Area = \int_0^{2\pi} i_L \, d(\omega t)$$

$$= \int_0^{\pi} I_m \sin \omega t \, d(\omega t) + \int_{\pi}^{2\pi} 0 \, d(\omega t)$$

$\omega t = z$

$d(\omega t) = dz$

$$Area = \int_0^{\pi} I_m \sin z \, dz + 0$$

$$= 2 I_m \quad -(3)$$

Average value of the load current

$$I_{avg} = I_{dc} = \frac{area}{base}$$

$$= \frac{2 I_m}{2\pi}$$

$$= \frac{I_m}{\pi} \quad - (4)$$

Assumptions:-
No resist on forward bias
Negl. res. in sec. winding

DC voltage across the load resistance R_L,

$$V_{dc} = I_{dc} \times R_L = \frac{I_m}{\pi} \times R_L - (5)$$

If diode res. isn't negligible & ~~load~~ diode resistance is comparable to R_L

$$I_m = \frac{V_m}{R_L} \Rightarrow I_m = \frac{V_m}{r_d + R_L}$$

$$V_{dc} = \frac{I_m}{\pi} \times R_L$$

$$= \frac{V_m}{\pi (r_d \times R_L)} \times R_L$$

$$V_{dc} = \frac{V_m}{\pi} \times \frac{R_L}{(r_d + R_L)}$$

$$= \frac{V_m R_L}{\pi (r_d + R_L)} = \frac{V_m}{\pi \left(1 + \frac{r_d}{R_L}\right)}$$

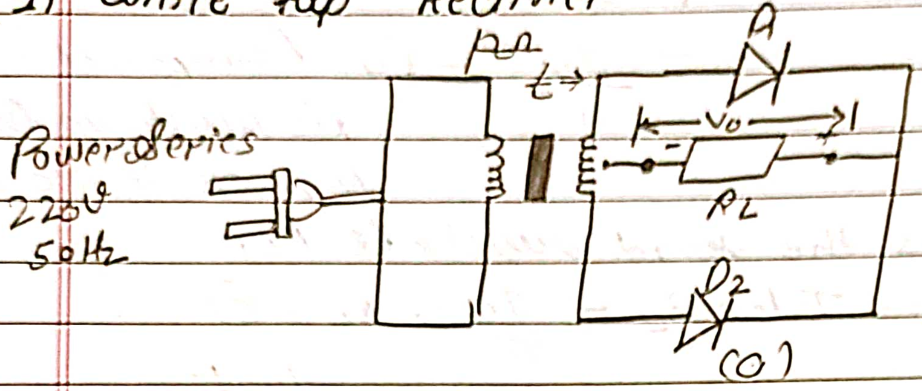
$$= \frac{V_m}{\pi} \quad \left[\text{if } r_d << R_L\right]$$

• Full-Wave Rectifier :

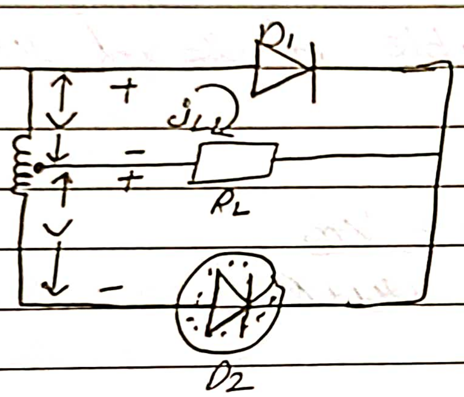
(1) Centre tap Rectifier

(2) ~~Rich~~ Bridge Rectifier

(1) Centre tap Rectifier

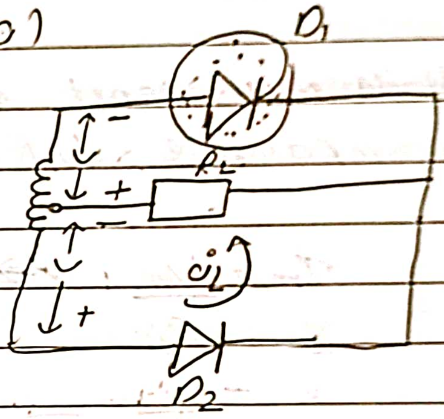


(a)



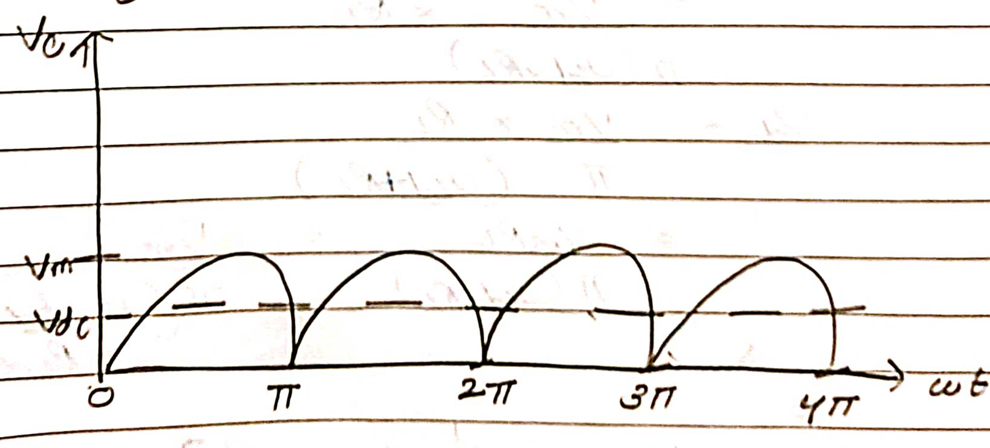
(b)

+ve half cycle



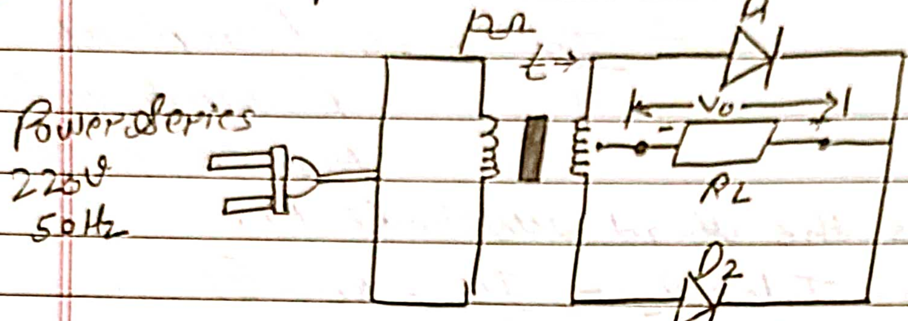
(c)

−ve half cycle

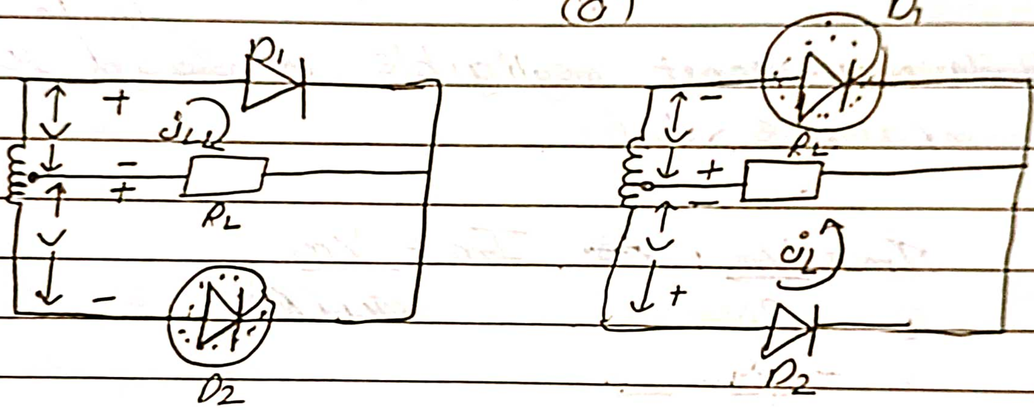


- Full-Wave Rectifier:
  (1) Centre tap Rectifier
  (2) ~~Rich~~ Bridge Rectifier

(1) Centre tap Rectifier

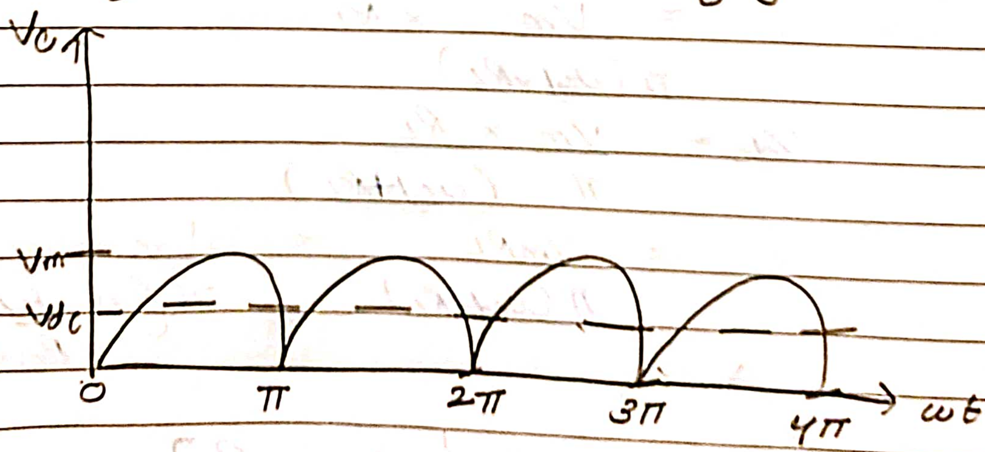


(a)



(b)
+ve half cycle

(c)
-ve half cycle



During the +ve half cycle of second ary voltage the diode D_1 is forward biased and D_2 is reverse biased.

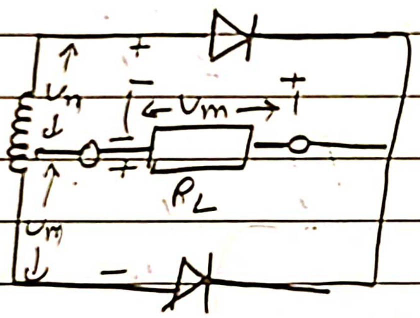
The current flows through the diode D_1 load resistor R_L and the upper half of the winding as shown in the figure no. (b).

During the -ve half cycle diode D_2 is forward biased and D_1 is reverse biased. Then D_2 will conduct.

The load resistor current in (b) & (c) is same.

PIV for Center Tap:

$PIV = 2V_m$



The reverse voltage that appears across the non-conducting diode is the summation of the voltage across the load resistor R_L.

During the +ve half cycle of second ary voltage the diode D_1 is forward biased and D_2 is reverse biased

The current flows through the diode D_1 load resistor R_L and the upper half of the winding as shown in the figure no. (b).

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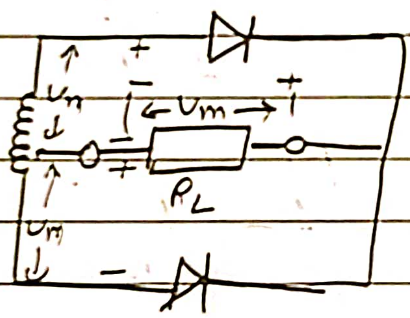
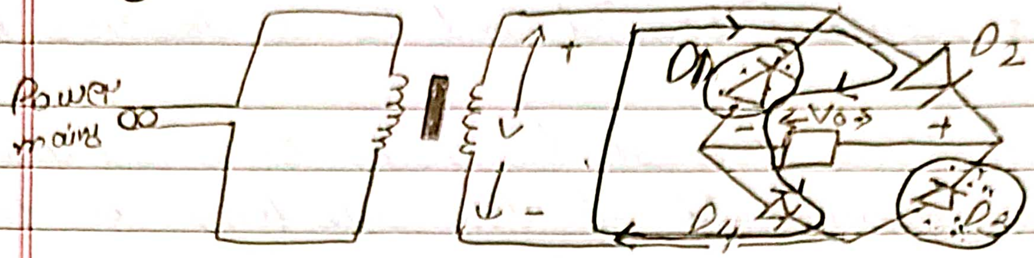


$PIV = 2V_m$

The reverse voltage that appears across the non-conducting diode is the summation of the voltage across the load resistor R_L.

2. Bridge Wave Rectifier:

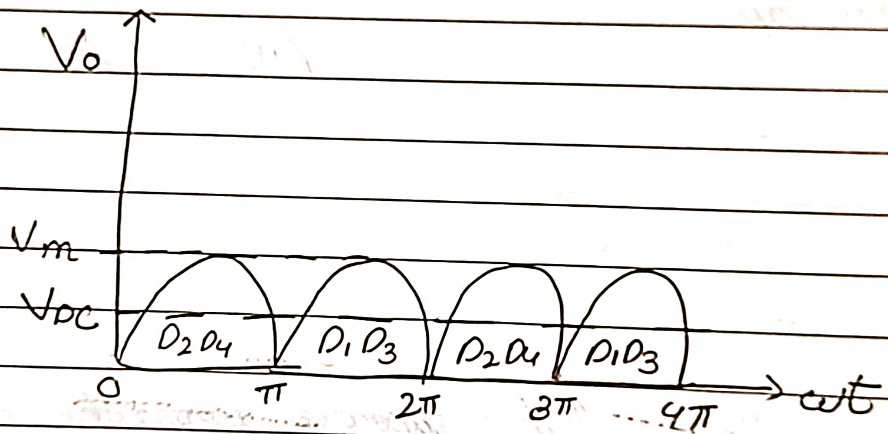


Positive Half Cycle D_2 & D_4 → forward bias → Conduct

D_1 & D_3 → Reverse Bias → Do not conduct

Negative Half Cycle D_1 & D_3 → ~~Re~~ for. bias → Conduct

D_2 & D_4 → reverse bias → Do not conduct



PIV: V_m

* V_m is the max. voltage across secondary winding in bridge wave & V_m is the max. voltage across half the secondary winding in centre tap.

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- Output dc voltage in various rectifiers:

$$V_{dc} = \frac{2V_m}{\pi}$$

The output voltage of a full-wave rectifier is described as:

$$V_o = V_m \sin\omega t \quad 0 \le \omega t \le \pi$$
$$= -V_m \sin\omega t \quad \pi \le \omega t \le 2\pi$$

The average or the dc value of voltage is

$$V_{dc} = \frac{1}{2\pi}\int_0^{2\pi} V_o\, d(\omega t)$$

$$= \frac{1}{2\pi}\left[\int_0^{\pi} V_m \sin\omega t\, d(\omega t) - \int_{\pi}^{2\pi} V_m \sin\omega t\, d(\omega t)\right]$$

$$= \frac{1}{2\pi} V_m \left[\int_0^{\pi} \cancel{V_m} \sin t\, dt - \int_{\pi}^{2\pi} \sin t\, dt\right]$$

$$\cancel{= \frac{1}{2\pi} \quad -\cos t + [\cos t]_{\pi}^{2\pi}}$$

$$= (+2+2)\frac{V_m}{2\pi}$$

$$= \frac{2V_m}{\pi}$$

- Ripple factor:

Ripple factor is a measure of purity of dc output of a rectifier

$$r = \frac{\text{r.m.s value of components of wave}}{\text{average or d.c value.}}$$

- **Rectification efficiency:**
It tells us what percentage of total input AC power is converted into dc output power.

$$\eta = \frac{\text{dc power delivered to load}}{\text{ac input power from Transformer } (T_x) \text{ secondary}}$$

$$= \frac{P_{dc}}{P_{ac}}$$

- **Performance of half-wave rectifier:**

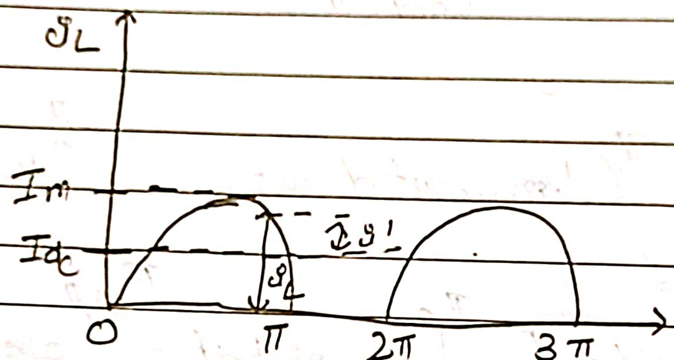

Fig: Half- Wave Rectified current Value.

(The instantaneous ac component of current is the difference b/w instantaneous total current & dc current i.e.

$$i' = i_L - i_{dc}$$

$$i_L = I_m \sin \omega t \quad \text{for } 0 \le \omega t \le \pi$$
$$\quad\quad 0 \quad\quad \text{for } \pi \le \omega t \le 2\pi$$

⇒ RMS value of current :
The rms or effective value of the current flowing through the load is given by,

- Rectification efficiency:
  It tells us what percentage of total input AC power is converted into dc output power.

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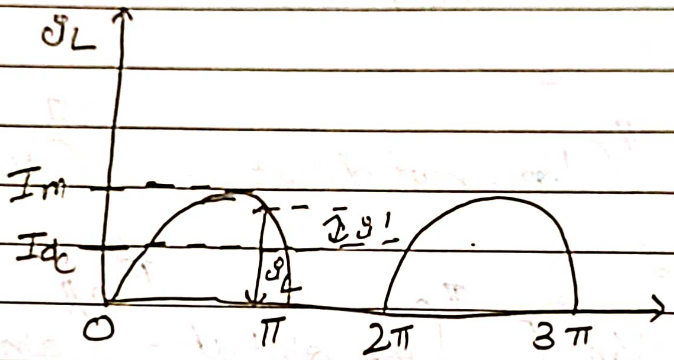

Fig: Half-Wave Rectified current value.

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$$i' = i_L - i_{dc}$$

$$i_L = \begin{cases} I_m \sin\omega t & \text{for } 0 \le \omega t \le \pi \\ 0 & \text{for } \pi \le \omega t \le 2\pi \end{cases}$$

⇒ RMS value of current :-
The rms or effective value of the current flowing through the load is given by;

$$I_{rms} = \sqrt{\frac{1}{2\pi} \int_0^{2\pi} i_L^2 \, d(\omega t)}$$

$$= \frac{I_m}{\sqrt{2\pi}} \sqrt{\int_0^{\pi} \frac{1 - \cos 2\omega t}{2}}$$

$$= \frac{I_m}{\sqrt{2\pi}} \sqrt{\frac{\pi}{2} - \left[\frac{\sin 2\omega t}{2}\right]_0^{\pi}}$$

$$= \frac{I_m}{2}$$

$$i' = i_L - i_{dc}$$

The rms value of ac component.

$$I'_{rms} = \sqrt{\frac{1}{2\pi} \int_0^{2\pi} (i_L - i_{dc})^2 \, d(\omega t)}$$

$$I'_{rms} = \sqrt{I^2_{rms} - I^2_{dc}}$$

$$\gamma = \frac{I'_{rms}}{I_{dc}}$$

$$= \frac{\sqrt{I^2_{rms} - I^2_{dc}}}{I_{dc}}$$

$$= \sqrt{\frac{I^2_{rms}}{I^2_{dc}} - 1}$$

$$= \sqrt{(1.57)^2 - 1}$$

$$\boxed{\gamma = 1.21}$$

- **Rectification efficiency of half-wave rectifier:**

The dc power delivered to the load,

$$P_{dc} = I^2_{dc} R_L = \left(\frac{I_m}{\pi}\right)^2 R_L$$

The total ac input power is

$$P_{ac} = I^2_{rms}(r_f + R_L)$$

$$= \left(\frac{I_m}{2}\right)^2 (r_f + R_L)$$

So

$$\eta = \frac{P_{dc}}{P_{ac}} = \left(\frac{I_m}{\pi}\right)^2 \times \left(\frac{2}{I_m}\right)^2 \times \frac{R_L}{r_f + R_L}$$

$$= \frac{4}{\pi\left(1 + \frac{r_f}{R_L}\right)} \times 100\%$$

$$= \cancel{\frac{400}{\pi\left(1 + \frac{r_f}{R_L}\right)}} \quad \frac{40.6\%}{1 + \frac{r_f}{r_L}}$$

- **Performance of full-wave rectifier.**

RMS value of current

$$I_{rms} = \frac{1}{\sqrt{2\pi}} \sqrt{\int_0^{\pi} I_m^2 \sin^2\omega t + \int_{\pi}^{2\pi} I_m^2 \sin^2 \omega t}$$

$$= \frac{I_m \times \sqrt{2}}{\sqrt{2\pi}} \int_0^{2\pi} \frac{1 - \cos 2\omega t}{2}$$

$$= \frac{I_m}{\sqrt{\pi}} \sqrt{\pi - \frac{\sin 2\omega t}{2}}$$

$$= \frac{I_m}{\sqrt{\cancel{2\pi}}} \quad \frac{I_m}{\sqrt{2}}$$

RMS value of current

$$I_{rms} = \frac{1}{\sqrt{2\pi}} \sqrt{\int_0^{\pi} I_m^2 \sin^2 \omega t}$$

$$= \frac{I_m}{\sqrt{2\pi}} \times \sqrt{\pi}$$

$$= \frac{I_m}{\sqrt{2}}$$

$$i' = i_L - i_{dc} \quad ; \quad i_{dc} = \frac{2I_m}{\pi}$$

$$I'_{rms} = \cancel{i_L - i} \quad \sqrt{I^2_{rms} - I^2_{dc}}$$

$$r = \frac{I'_{rms}}{I_{dc}}$$

$$= \sqrt{\frac{I^2_{rms}}{I^2_{dc}} - 1}$$

$$= \sqrt{\left(\frac{I_m}{\sqrt{2}}\right)^2 \times \frac{\pi^2}{4 I_m^2} - 1}$$

$$= \sqrt{\frac{\pi^2}{8} - 1}$$

$$= 0.482$$

⇒ Rectification efficiency:

$$P_{dc} = I^2_{dc} R_L = \left(\frac{2I_m}{\pi}\right)^2 R_L$$

$$\text{Total ac Power} = I^2_{rms} (r_d + R_L)$$

$$= \frac{I_m^2}{2} r_d + R_L$$

$$\eta = \frac{\frac{4I_m^2}{\pi^2} \times R_L}{\frac{I_m^2}{2}(r_d + R_L)} \times 100 = \frac{8}{\pi^2} \times 100 \times \frac{1}{\frac{r_d}{r_L} + 1}$$

$$= \frac{81.2\%}{1 + \frac{r_d}{R_L}}$$

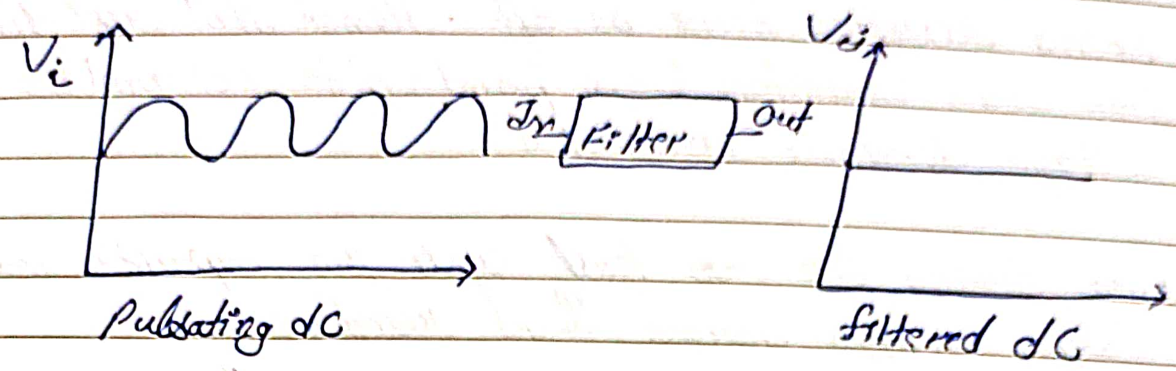
• Comparison of different rectifiers

	Half-Wave Rectifier	Full-Wave Rectifiers. i Centre tap	ii Full Wave
1. No. of diodes	1	2	4
2. Tx necessary	No	Yes	~~Yes~~ No
3. Peak Sec. Volt.	V_m	$2V_m$	V_m
4. Peak load current (I_m)	$\frac{V_m}{r_d+R_L}$	$\frac{V_m}{r_d+R_L}$	$\frac{V_m}{r_d+R_L}$
5. I_{rms}	$\frac{I_m}{2}$	$\frac{I_m}{\sqrt{2}}$	$\frac{I_m}{\sqrt{2}}$
6. I_{dc}	$\frac{I_m}{\pi}$	$\frac{2I_m}{\pi}$	$\frac{2I_m}{\pi}$
7. r	1.21	0.482	0.482
8. η	40.6%	81.2%	81.2%

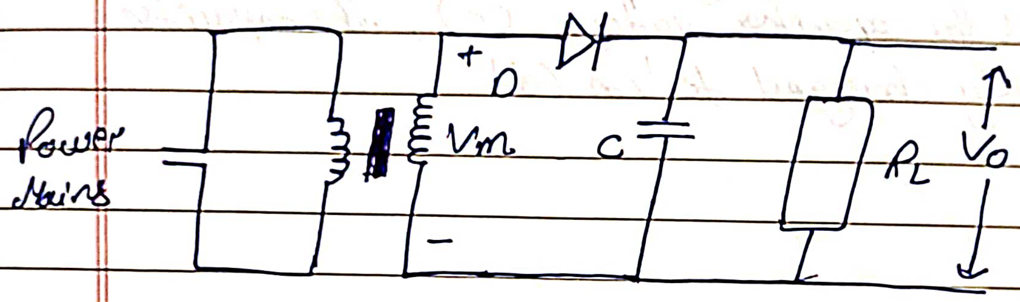
Transformer may be used for isolation even if not required for stepping up or down the input ac.

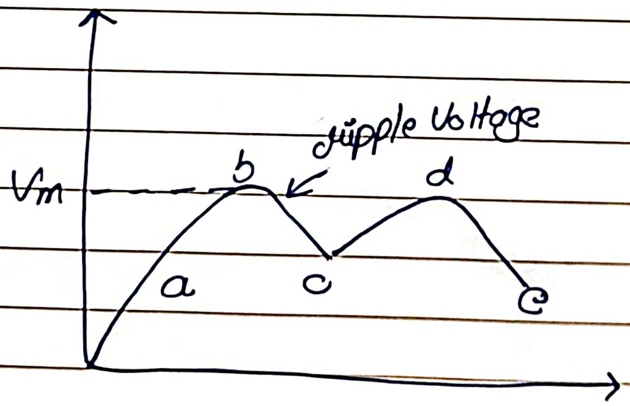
- Filters:

To minimise the ripple content.



- Shunt Capacitor filter →





- When the +ve half cycle of the AC input is applied the diode is in forward bias and hence it'll conduct. So this allows the capacitor to quickly charge upto Vm, i.e. upto (b).

ii After +ve fully charge, the capacitor holds the charge till the input ac supply to the rectifier goes negative.

iii During the -ve half cycle the capacitor attempts to discharge. However, it can't discharge through diode being reverse bias is off. Hence it'll ~~start~~ discharge from load resistor from point (b) to (c) and its voltage decreases somewhat.

iv Even during the -ve half cycle the capacitor maintains large voltage across load resistor.

v During the next +ve half cycle when the rectifier voltage exceeds the capacitor voltage (c), the capacitor is again quickly charged to Vm (d).