Padasalai's
Telegram Groups!

(தலைப்பிற்கு கீழே உள்ள லிங்கை கிளிக் செய்து குழுவில் இணையவும்!)

- Padasalai's NEWS - Group

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- Padasalai's Channel - Group

https://t.me/padasalaichannel

- Lesson Plan - Group

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- 12th Standard - Group

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UNIT - 7

1. Einstein's photoelectric equation :

- When a photon of energy $h\nu$ is incident on a metal surface.
- A part of the photon energy is used for ejection of the electron and the remaining energy as kinetic energy of the ejected electron.

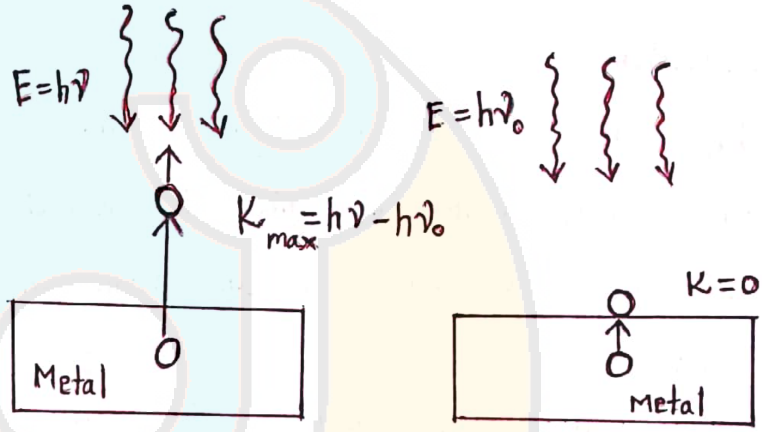
$$h\nu = \phi_0 + \frac{1}{2}mv^2 \longrightarrow (1)$$

When $\boxed{\nu = \nu_0}$ $\Rightarrow$ $K.E = 0$

$$h\nu_0 = \phi_0 \longrightarrow (2)$$

sub eq (2) in eq (1)

$$\boxed{h\nu = h\nu_0 + \frac{1}{2}mv^2}$$



2. Principle and working of electron microscope :-

Principle :-

- The wave nature of particles.
- The resolving power of a microscope is inversely proportional to the wavelength of the radiation.

Working :-

- The construction and working of an electron microscope is similar to that of an optical microscope except that in electron microscope focussing of electron beam is done by the magnetic lenses.

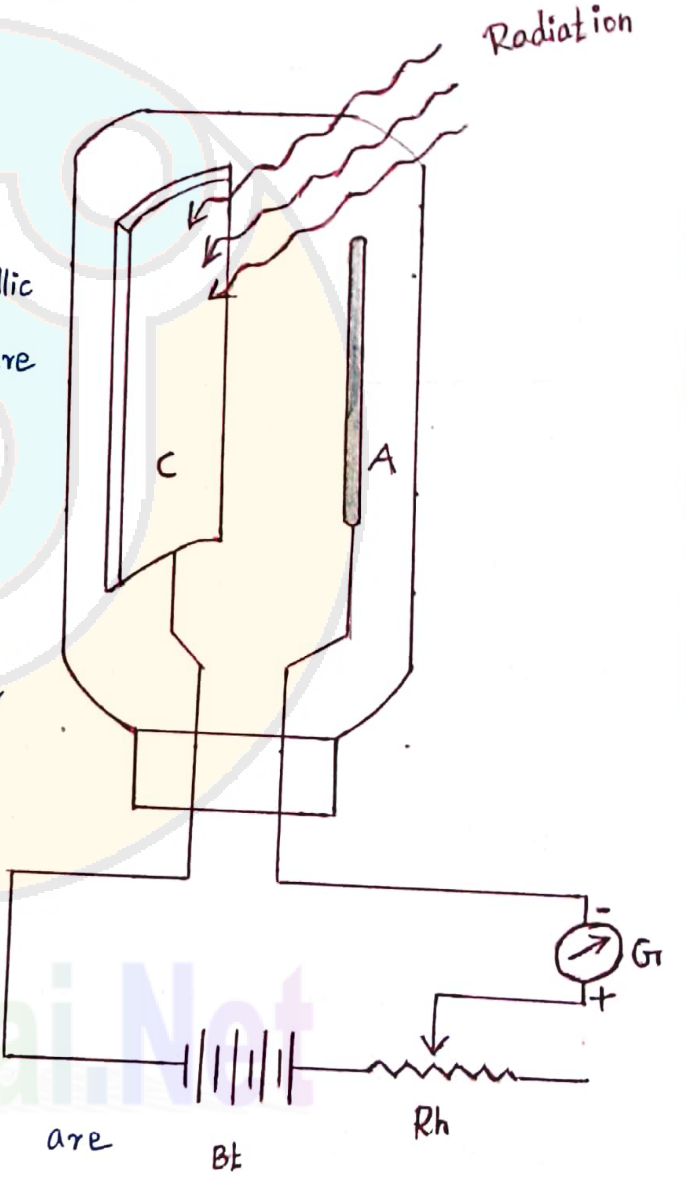
DIAGRAM REFER BOOK

- The electrons emitted from the source are accelerated by high potentials.

- The beam is made parallel by magnetic condenser lens.
- When the beam passes through the sample whose magnified image is needed, the beam carries the image of the sample.
- With the help of magnetic objective lens and magnetic projector lens system, the magnified image is obtained on the screen.

3. Principle, Construction and working of photoemissive cell.

Principle:- ◻ Photoelectric effect.



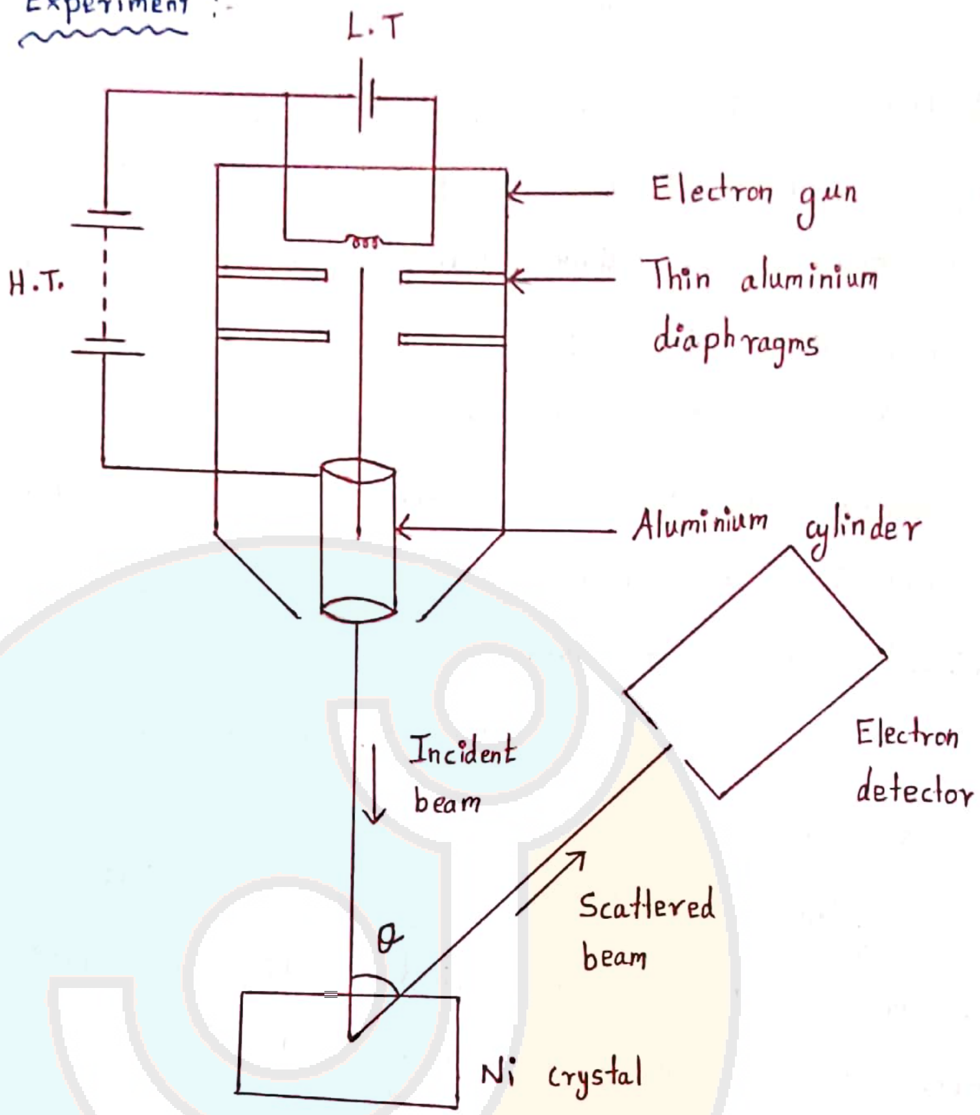
Construction:

- It consists of an evacuated glass or quartz bulb in which two metallic electrodes - a cathode & an anode are fixed.
- The cathode is semi-cylindrical in shape and is coated with a photo sensitive material.
- The anode A is a thin rod or wire.
- A potential difference is applied between the anode and the cathode through a galvanometer G.

Working:

- When C is illuminated, electrons are emitted from it.
- These electrons are attracted by anode and hence a current is produced which is measured by the galvanometer.
- For a given cathode, the magnitude of the current depends on the intensity and potential difference.

4) Davisson - Germer Experiment :-



- The filament F is heated by a low tension battery.
- The Electrons are emitted from the hot filament.
- They are accelerated due to the potential difference by a high tension battery.
- Electron beam is collimated by using two thin aluminium diaphragms.
- It is allowed to strike a single crystal of Nickel.
- The electrons scattered by Ni atoms in different directions are received by the electron detector which measures the intensity of scattered electron beam.
- By $\lambda = \frac{12.27}{\sqrt{V}}$ Å where V = 54V, wavelength found to be 1.67 Å
- This value agree well with experimentally observed wavelength of 1.65 Å.

5) Electron emission and its types :

Electron emission : The liberation of electrons from any surface of a substance is called electron emission.

- There are mainly four types of electron emission.

1. Thermionic emission :

- When a metal is heated to a high temperature, the free electrons on the surface of the metal get sufficient energy in the form of thermal energy so that they are emitted from the metal surface.
- E.G. Electron microscope, X-ray tube

2. Field emission :

- When a very strong electric field is applied across the metal. This strong field pulls the free electrons and helps them to overcome the surface barrier of the metal.
- E.G. Field emission display.

3. Photo electric emission :

- When an electromagnetic radiation of suitable frequency is incident on the surface of the metal, the energy is transferred from the radiation to the free electrons. The photo electric emission takes place.
- E.G. Photo diodes, Photo electric cells.

4. Secondary emission :

- When a beam of fast moving electrons strikes the surface of the metal, the kinetic energy of the electrons is transferred to the free electrons on the metal. The secondary emission takes place. ▫ E.G Photo multiplier tubes.

6. Obtain the Law of radioactive decay :

- At any instant t, the number of decays per unit time, called rate of decay $\left[\frac{dN}{dt}\right]$ is proportional to the number of nuclei [N] at the same instant.

$$\frac{dN}{dt} \propto N$$

$$\frac{dN}{dt} = -\lambda N \longrightarrow (1)$$

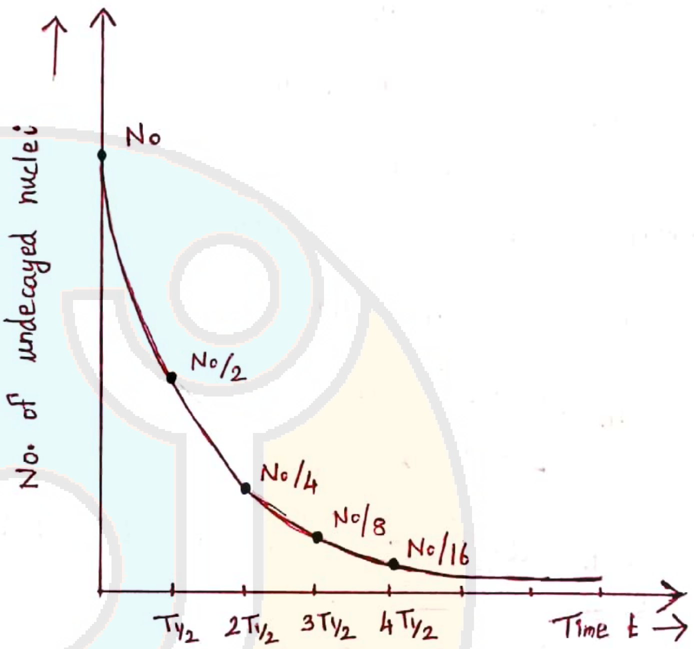
$\lambda \rightarrow$ Decay constant

If $t = 0$; $N = N_0$

$$\frac{dN}{N} = -\lambda dt$$

$$\int_{N_0}^{N} \frac{dN}{N} = -\int_{0}^{t} \lambda \, dt$$

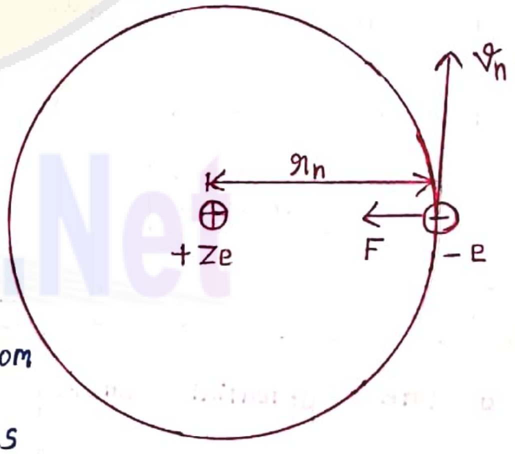
$$N = N_0 e^{-\lambda t}$$



Number of atoms is decreasing exponentially over the time.

7. Radius of the orbit of the electron :

- Consider an atom which contains the nucleus at rest and an electron revolving around the nucleus in a circular orbit of radius r_n.



- Let $Z \rightarrow$ The atomic No. of the atom

  $+Ze \rightarrow$ The charge of the nucleus

  $-e \rightarrow$ The charge of the electron.

- From Coulomb's law,

$$\vec{F}_{Coulomb} = \frac{-1}{4\pi\varepsilon_0} \frac{Ze^2}{r_n^2} \hat{r}$$

Centripetal force,

$$\vec{F}_{cp} = \frac{m v_n^2}{r_n} \hat{r}$$

$m \rightarrow$ Mass of electron

$v_n \rightarrow$ Velocity of electron

$$|\vec{F}_{Coulomb}| = |\vec{F}_{cp}|$$

$$\frac{1}{4\pi\varepsilon_0} \frac{Ze^2}{r_n^2} = \frac{m v_n^2}{r_n}$$

$$r_n = \frac{4\pi\varepsilon_0 [m v_n r_n]^2}{Zme^2}$$

From Bohr's assumption,

$$m v_n r_n = l_n = n\hbar$$

$$r_n = \left[\frac{\varepsilon_0 h^2}{\pi m e^2}\right] \frac{n^2}{Z}$$

$$\boxed{r_n = a_0 \frac{n^2}{Z}} \quad [\because a_0 = 0.529 \text{ Å}]$$

From Hydrogen atom,

$Z = 1 \Rightarrow r_n = a_0 n^2$

For $n = 1 \Rightarrow r_1 = a_0 = 0.529$ Å

For $n = 2 \Rightarrow r_2 = 4a_0 = 2.116$ Å

For $n = 3 \Rightarrow r_3 = 9a_0 = 4.761$ Å

i.e. $\boxed{r_n \propto n^2}$

8. The energy of an electron in the n^{th} orbit :-

- The potential energy for the n^{th} orbit

$$U_n = \frac{-1}{4\varepsilon_0^2} \frac{Z^2 m e^4}{h^2 n^2}$$

- The kinetic energy for the n^{th} orbit

$$KE_n = \frac{me^4}{8\varepsilon_0^2 h^2} \frac{Z^2}{n^2}$$

$$E_n = U_n + KE_n$$

$$E_n = -\frac{me^4}{8\varepsilon_0^2 h^2}\frac{Z^2}{n^2}$$

For Hydrogen atom, $Z = 1$

$$E_n = -\frac{me^4}{8\varepsilon_0^2 h^2}\frac{1}{n^2} \text{ joule}$$

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9) Spectral series of Hydrogen atom.

1. Lyman series:

- Electron jumps from any of the outer orbits [illegible] to the first orbit.
- $m = 2, 3, 4 \ldots$; $n = 1$
- $\bar{\nu} = R\left[\frac{1}{1^2} - \frac{1}{m^2}\right]$
- Ultraviolet region

2. Balmer series:

- Electron jumps from any of the outer orbits to the second orbit.
- $m = 3, 4, 5 \ldots$; $n = 2$
- $\bar{\nu} = \frac{1}{\lambda} = R\left[\frac{1}{2^2} - \frac{1}{m^2}\right]$
- Visible region

By.

3. Paschen series:

- Electron jumps from any of the outer orbits to the third orbit.
- $m = 4, 5, 6 \ldots$; $n = 3$
- $\bar{\nu} = \frac{1}{\lambda} = R\left[\frac{1}{3^2} - \frac{1}{m^2}\right]$
- Near Infrared region

4. Brackett series :

- Electron jumps from any of the outer orbits to the fourth orbit.
- $m = 5, 6 \cdots \quad ; \quad n = 4$
- $\bar{\nu} = \frac{1}{\lambda} = R\left[\frac{1}{4^2} - \frac{1}{m^2}\right]$
- Middle Infrared region

5. Pfund series:

- Electron jumps from any of the outer orbits to the fifth orbit
- $m = 6, 7, \cdots \quad ; \quad n = 5$
- $\bar{\nu} = \frac{1}{\lambda} = R\left[\frac{1}{5^2} - \frac{1}{m^2}\right]$
- Far Infrared region

UNIT-9

10) State and prove De Morgan's theorems.

First theorem :-

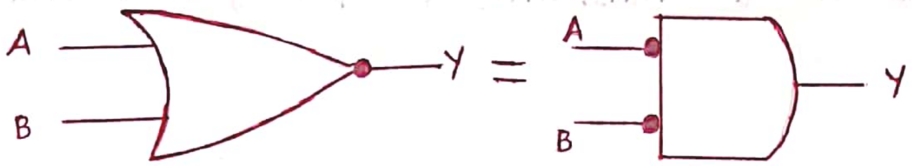
- The complement of the sum of two logical inputs is equal to the product of its complements. $\overline{A+B} = \bar{A}\cdot\bar{B}$

Proof :

- The Boolean equation for NOR gate is $Y = \overline{A+B}$
- The Boolean equation for a bubbled AND gate is $Y = \bar{A}\cdot\bar{B}$

A	B	A+B	$\overline{A+B}$	$\bar{A}$	$\bar{B}$	$\bar{A}\cdot\bar{B}$
0	0	0	1	1	1	1
0	1	1	0	1	0	0
1	0	1	0	0	1	0
1	1	1	0	0	0	0

- It says that NOR gate is equal to a bubbled AND gate.



Second theorem :

- The complement of the product of two inputs is equal to the sum of its complements.

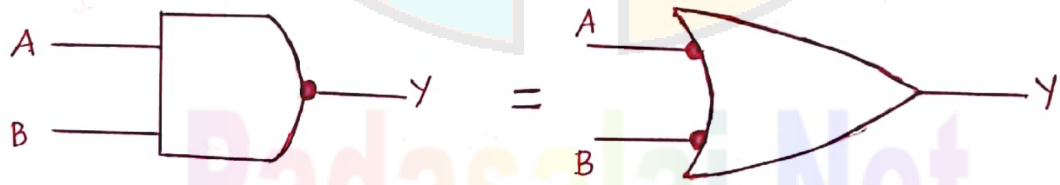
$$\overline{A \cdot B} = \overline{A} + \overline{B}$$

Proof :

- The Boolean equation for NAND gate is $Y = \overline{A \cdot B}$
- The Boolean equation for bubbled OR gate is $Y = \overline{A} + \overline{B}$

A	B	$A \cdot B$	$\overline{A \cdot B}$	$\overline{A}$	$\overline{B}$	$\overline{A} + \overline{B}$
0	0	0	1	1	1	1
0	1	0	1	1	0	1
1	0	0	1	0	1	1
1	1	1	0	0	0	0

- It says that NAND gate is equal to a bubbled OR gate.



11. Half wave rectifier :

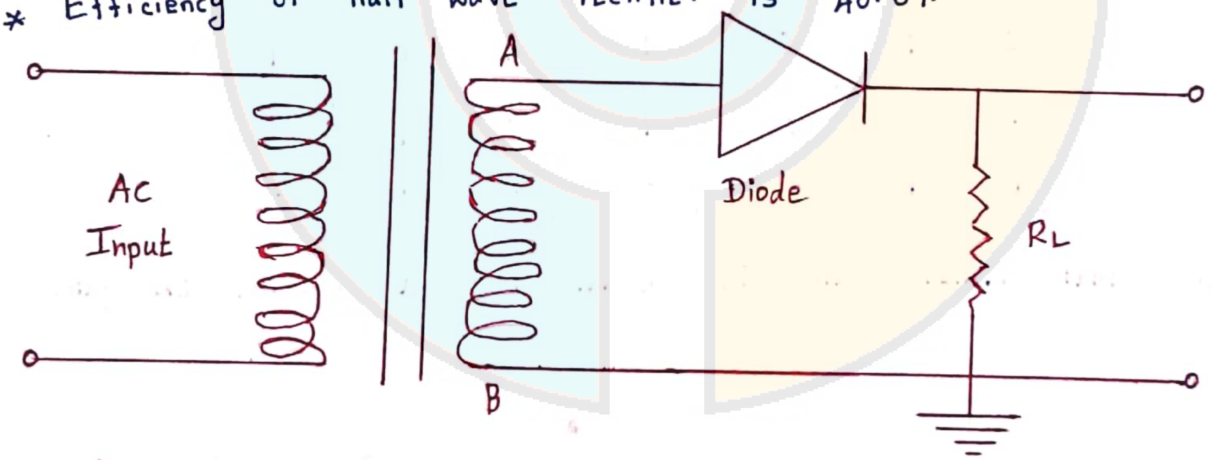
- In a half wave rectifier circuit, either a positive half [or] the negative half of the AC input is passed through while the other half is blocked.
- Only one half of the input wave reaches the output.

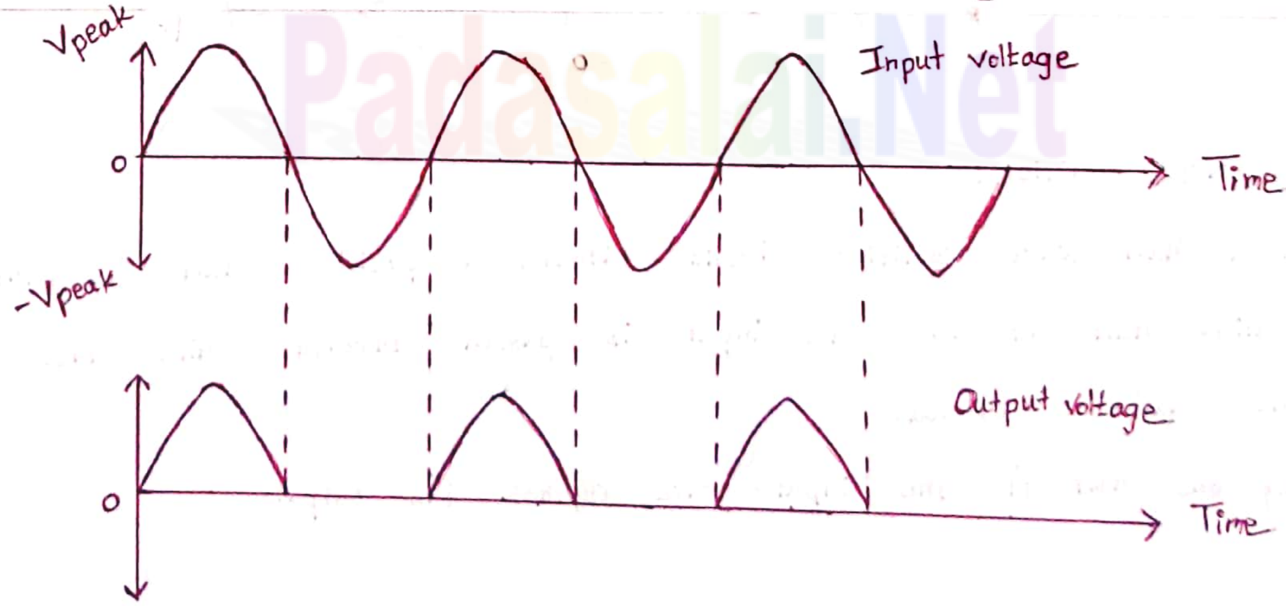
Construction:

- The circuit consists of a transformer, a p-n junction diode and a resistor.

Working:

- During the positive half cycle:
  * When the positive half cycle of the AC input signal passes through the circuit, A becomes positive with respect to B.
  * The diode is forward biased and hence it conducts.
- During the negative half cycle:
  * When the negative half cycle of the AC input signal passes through the circuit, A becomes negative with respect to B.
  * The diode is reverse biased and does not conduct the current.
  * Efficiency of half wave rectifier is 40.6%.



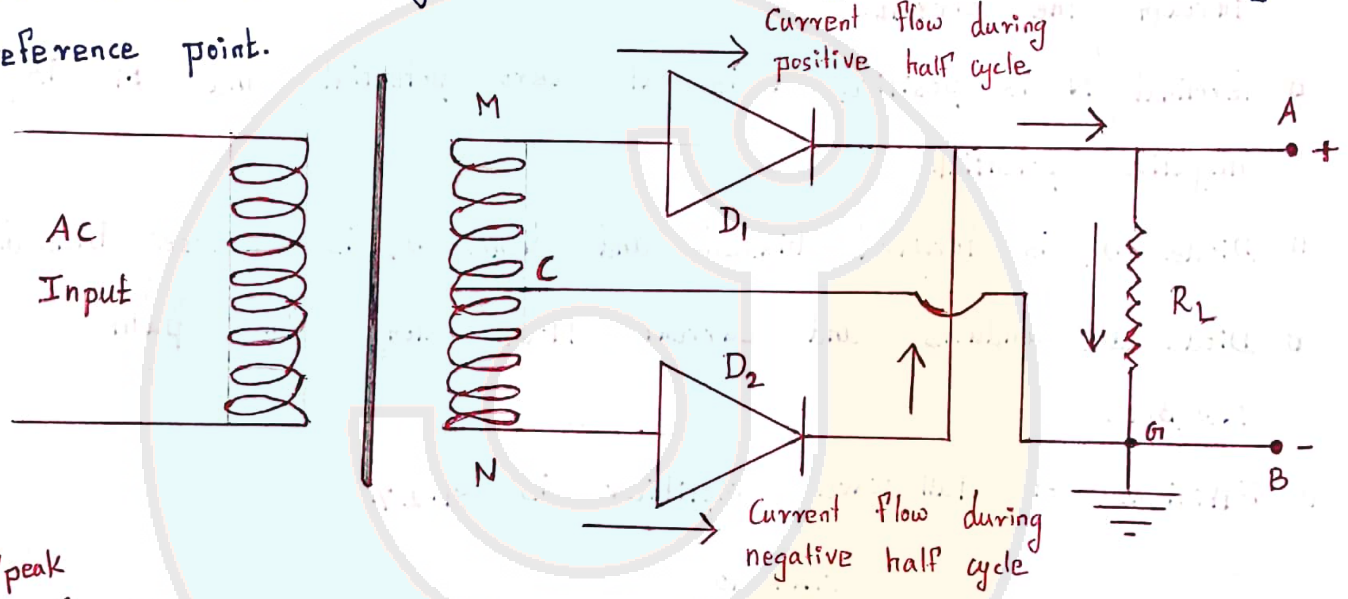


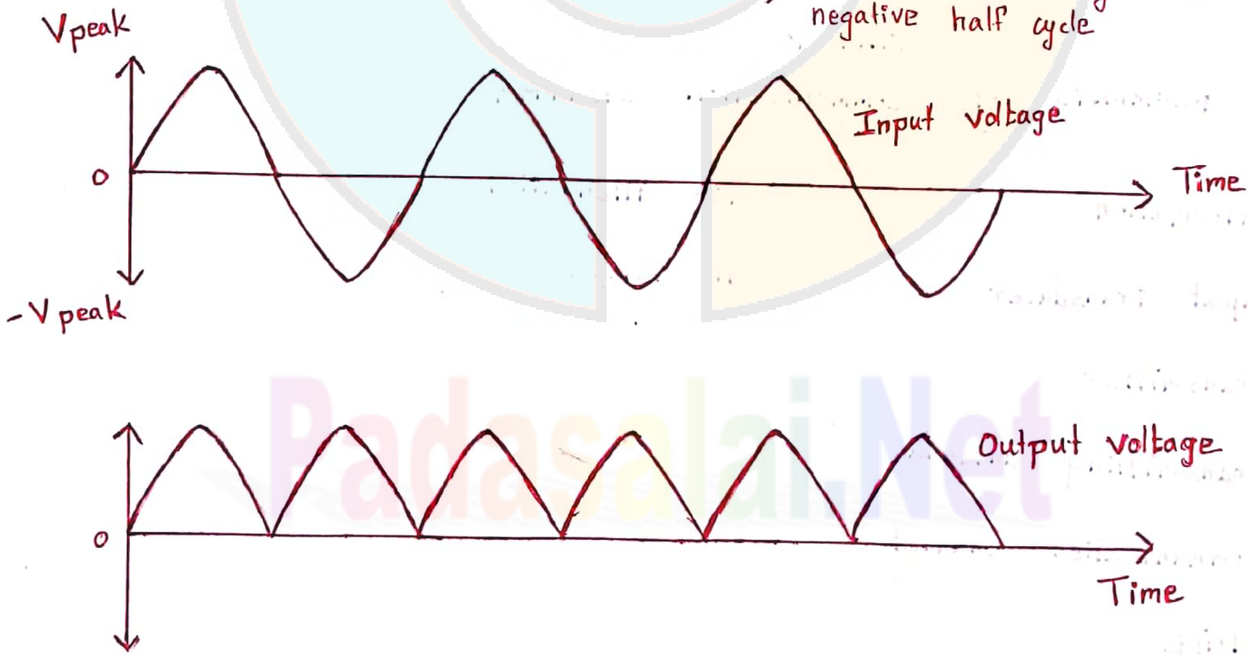
12) Full wave rectifier :-

- The positive and negative half cycles of the Ac input signal passes through the ~~full circuit~~ full wave rectifier circuit and hence it is called the full wave rectifier.

Construction :-

- It consists of two p-n junction diodes, a center tapped transformer and a load resistor [RL].
- The centre is usually taken as the ground or zero voltage reference point.





* During the positive half cycle :

- When the positive half cycle of the ac input signal passes through the circuit.

- Terminal M is positive, G is at zero potential and N is at negative potential.
- Diode D_1 is forward biased & diode D_2 is reverse biased.
- Diode D_1 conducts and current flows along the path MD_1AGC.

* **During the negative half cycle:-**

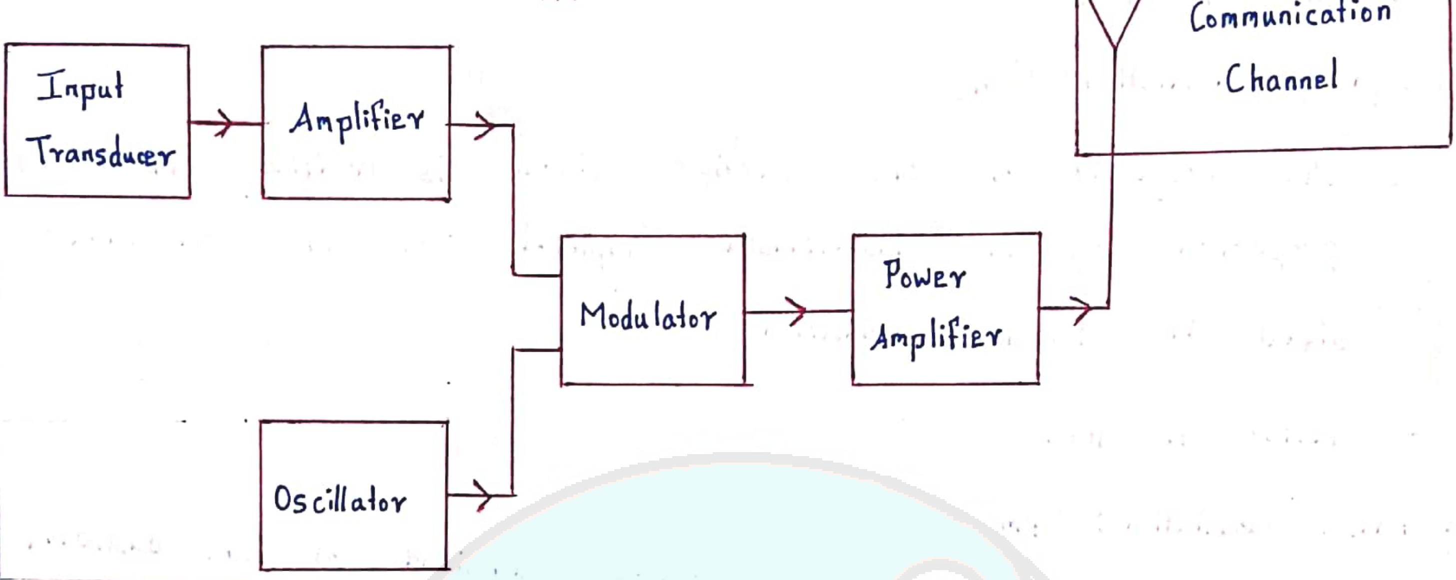
- When the negative half cycle of the AC input signal passes through the circuit.
- Terminal N is positive, G is at zero potential and M is at negative potential.
- Diode D_2 is forward biased and diode D_1 is reverse biased.
- Diode D_2 conducts and current flows along the path ND_2BGC.
- Efficiency of full wave rectifier is 81.2%.

UNIT - 10

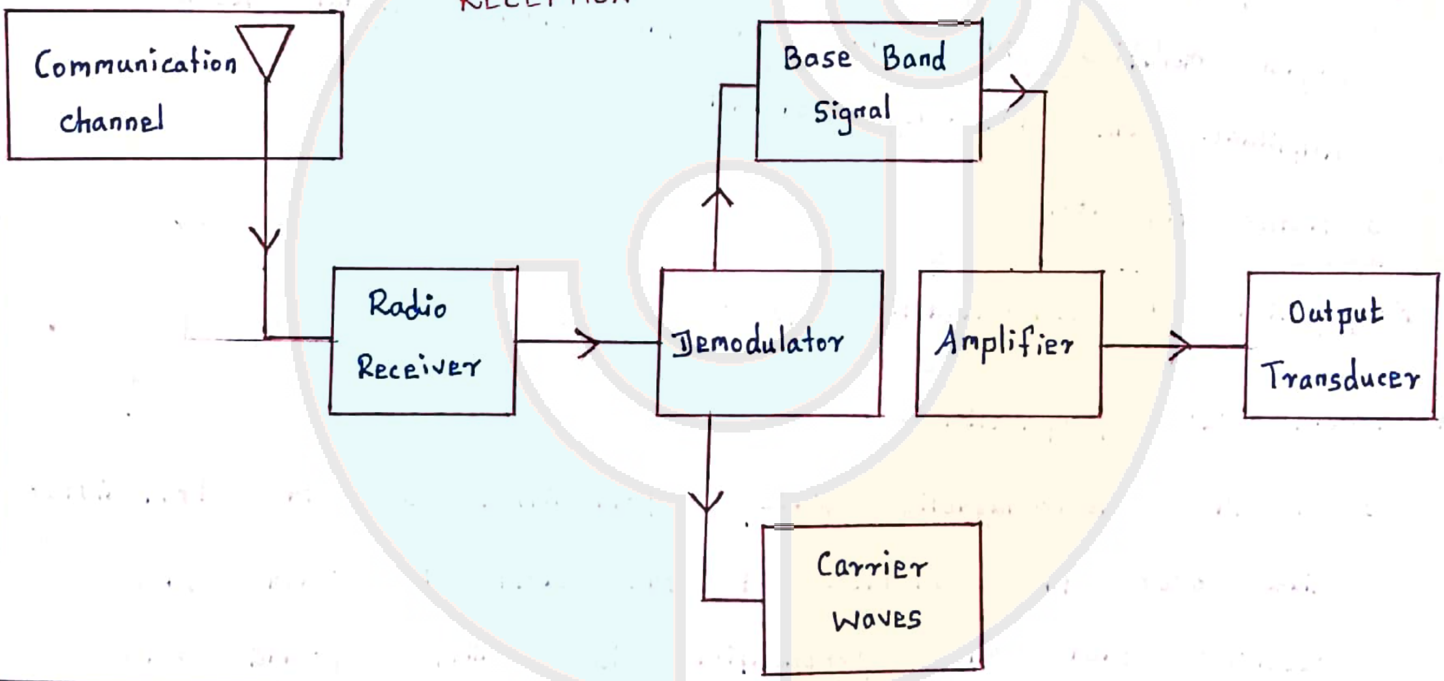
13. BASIC ELEMENTS OF COMMUNICATION SYSTEM:

1. Information
2. Input transducer
3. Transmitter
4. Transmitting antenna
5. Communication channel
6. Noise
7. Receiver
8. Repeaters
9. Output transducer
10. Attenuation
11. Range

TRANSMISSION



RECEPTION



14) Types of modulation :

* Modulation :
  - For long distance transmission, the low frequency baseband signal is superimposed onto a high frequency radio signal by a process called modulation.

* Amplitude modulation [AM] :
  - If the amplitude of the carrier signal is modified in proportion to the instantaneous amplitude of the baseband

signal, then it is called amplitude modulation.

- Refer fig 10.1.

* Frequency modulation: [FM]

- The frequency of the carrier signal is modified in proportion to the instantaneous amplitude of the baseband signal in frequency modulation.
- Refer fig 10.2.

* Phase modulation: [PM]

- In phase modulation, the instantaneous amplitude of the baseband signal modifies the phase of the carrier signal keeping the amplitude and frequency constant.
- Refer fig 10.3.

15) Propagation of electromagnetic waves:

* Ground wave propagation:

- If the electromagnetic waves transmitted by the transmitter glide over the surface of the earth to reach the receiver, then the propagation is called ground wave propagation.

* Sky wave propagation:

- The electromagnetic waves radiated from an antenna, directed upwards at large angles, gets reflected by the ionosphere back to earth is called sky wave propagation.

* Space wave propagation:

- The process of sending and receiving information signal through space is called space wave propagation.