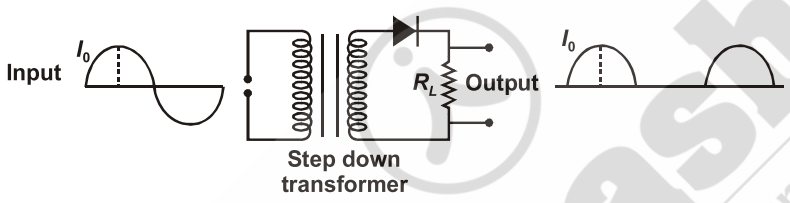
Chapter 17

Electronic Devices and Communication Systems

DIODE AS RECTIFIER

A device to convert ac into dc.

1. Half Wave Rectifier



$$I_{rms} = \frac{I_0}{2}$$

$$I_{mean} = \frac{I_0}{\pi}$$

$$\text{form factor} = \frac{I_{rms}}{I_{mean}} = 1.57$$

Important points :

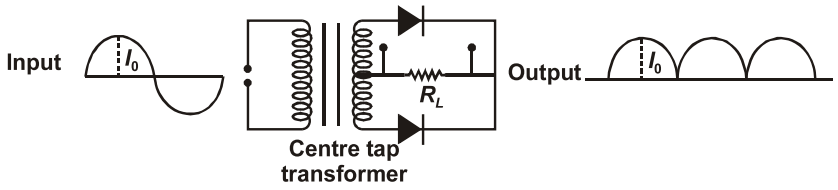
a. Input frequency = Out put frequency.

b. Maximum Efficiency = 40.6%

c. Ripple factor $r = \dfrac{\text{ac component}}{\text{dc component}} = \sqrt{\dfrac{I_{rms}^2}{I_{mean}^2} - 1} = 1.21.$

d. Efficiency of half wave rectifier $\eta = \dfrac{0.406 R_L}{r_f + R_L}$

2. Full Wave Rectifier



$$I_{rms} = \frac{I_0}{\sqrt{2}}$$

$$I_{mean} = \frac{2I_0}{\pi}$$

a. Out put frequency = 2 × input frequency

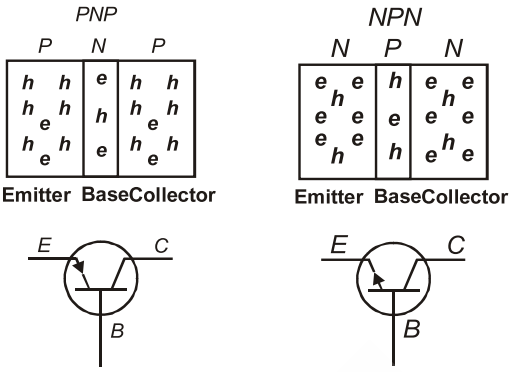
b. Maximum Efficiency = 81.2%.

c. Ripple factor r = 0.48.

d. Efficiency of full wave rectifier $\eta = \dfrac{0.812 R_L}{r_f + R_L}$

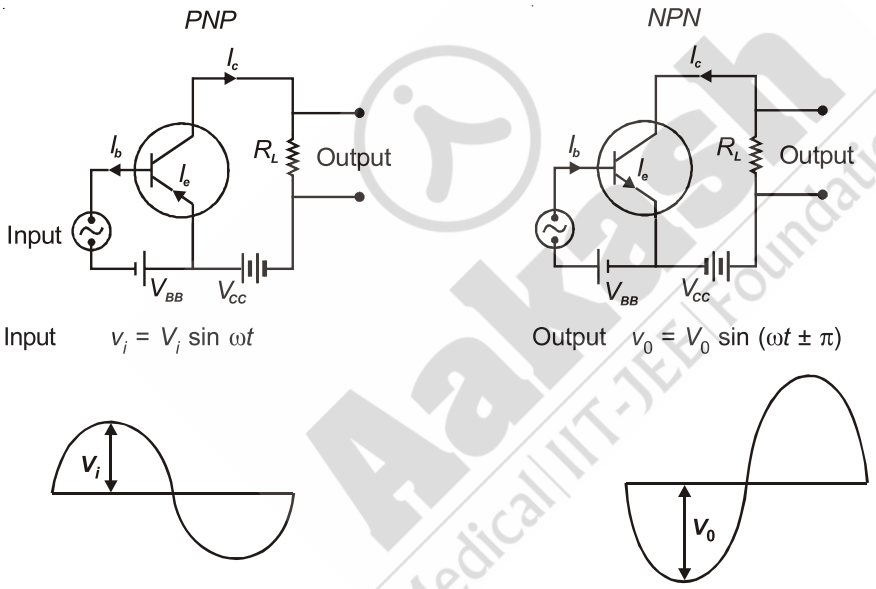
JUNCTION TRANSISTOR

Symbols used for transistors are shown here :



Common-Emitter (CE) Amplifier

$$I_e = I_b + I_c$$



Important Points related to CE-Amplifier

1. There is phase reversal of 180°.
2. DC current gain $\beta = \frac{I_c}{I_b}$.
3. AC current gain $\beta_{ac} = \frac{\Delta I_c}{\Delta I_b}$.
4. AC voltage gain $A_v = \frac{\Delta V_0}{\Delta V_i}$.
5. AC power gain = $\beta_{ac} \times A_v$ [maximum in *CE* mode]

6. Resistance gain $R_g = \frac{R_L}{R_i}$ (R_i = input resistance).

7. $\frac{1}{\alpha} - \frac{1}{\beta} = 1$

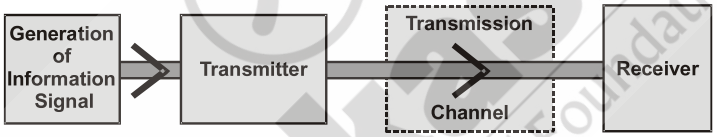
8. $\alpha < 1$, $\beta > 1$

9. Transconductance $g_m = \frac{\Delta I_c}{\Delta V_i}$

COMMUNICATION SYSTEMS

Communication of information to each other is a basic human activity. For example, one person wishes to tell something or give a message to another person sitting near him. Then he speaks and transmits sound waves through air medium or channel. The other person receives the message by listening through his/her ears. In modern communication systems the information is first converted into electrical signals or electromagnetic waves and then sent electronically. This has the advantage of speed, reliability and possibility of communicating over long distances.

The key to communication system is to obtain an electrical signal voltage or current which contains the information. For example, a microphone can convert speech signals into electrical signals. Similarly, pressure can be sensed by **piezoelectric** sensor which gives pressure in terms of electrical signal. A signal is defined as **a single-valued function of time (that conveys the information) and which, at every instant of time has a unique value.**



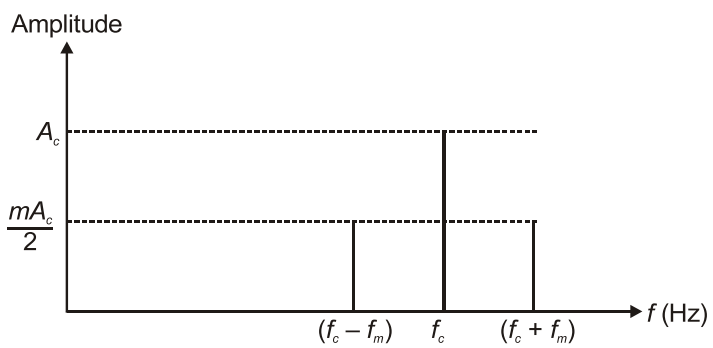
Basic units of all communication systems

1. An AM-wave is equivalent to the summation of three sinusoidal waves whose frequencies are ω_c, $(\omega_c + \omega_m)$ and $(\omega_c - \omega_m)$ and the amplitudes are respectively V_c, $\frac{mV_c}{2}$ and $\frac{mV_c}{2}$

2. The frequency f_c is known as **carrier frequency** and $(f_c + f_m)$ and $(f_c - f_m)$ are known as **Upper side band** and **Lower side band** respectively.

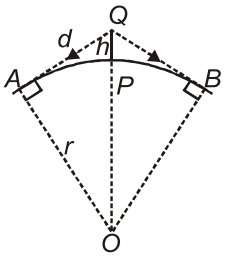
> ***Note :*** *In an AM-wave the difference between upper side band and lower side band (which is equal to $2f_m$) is known as the **band width**.*

Graphically, the carrier frequency and the side bands can be shown as :



Space Wave Propagation or Tropospheric Wave Propagation

The transmitted waves, travelling in a straight line, directly reach the receiver end and are then picked up by the receiving antenna. This mode of communication is termed as **Line of sight communication.**



Ray path of transmitted waves following space-wave (or line of sight) mode of propagation. The transmitter is located at the ground on a tall lower.

Range

$d = \sqrt{2rh}$ $\quad \begin{bmatrix} r : \text{Radius of earth} \\ h : \text{Height of transmitting antenna} \end{bmatrix}$

This distance is of the order of 40 km.

❑ ❑ ❑