(Wave Propogation & comm^n Engg.)

Q(t) Write the expression of Carrier Wave & explain Amplitude & Angle Modulation.

Carrier Wave equation → ∴ Carrier signal is a High freq. Sinusoidal Signal.

$$C(t) = A \cos \theta(t)$$

$$= A \cos (\omega t + \phi)$$

Characteristics of Carrier Wave

$A \to$ Amplitude of Carrier Signal

$\theta(t) \to$ Angle of " "

$\omega \to$ freq. of " " "

$\phi \to$ Phase angle of " " "

Amplitude Modulation →

If Carrier wave Amplitude i.e. $A$, varies continously according to the instantaneous value of Base-Ban (Message) signal, It is called Amplitude Modulation.
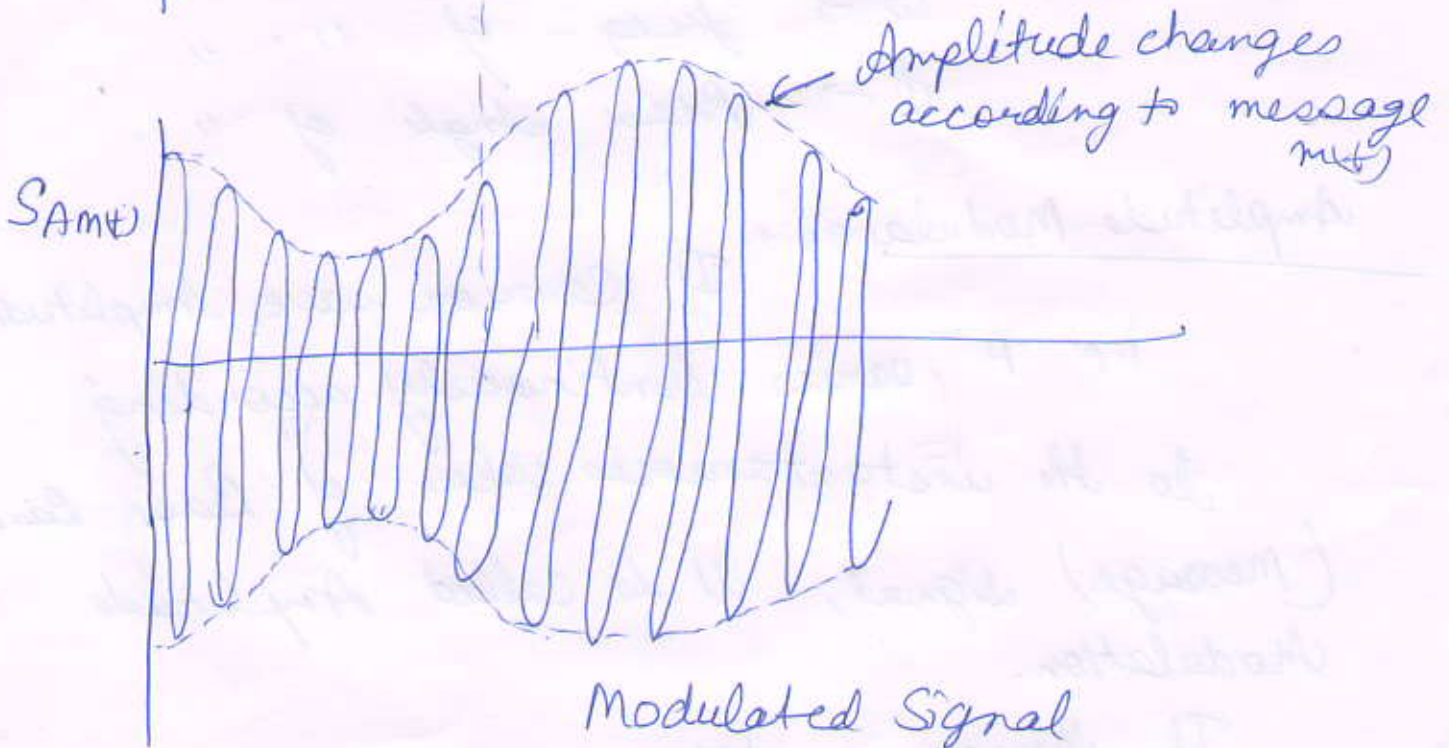
If Message is $m(t)$

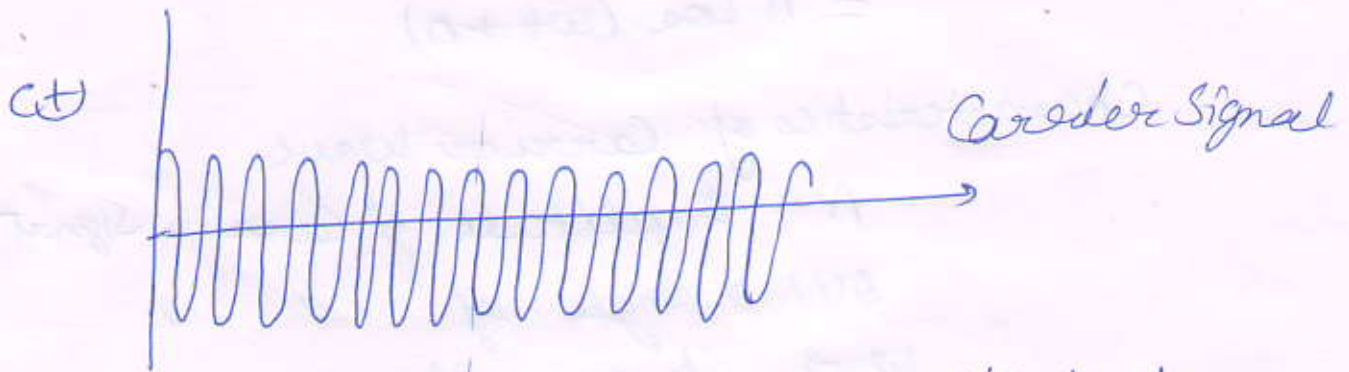Then Modulated Signal is

$$S_{AM}(t) = A_c \underbrace{[1 + K_a m(t)]} \cos (\omega t + \phi)$$

$$= A(t) \cos [\theta(t)]$$

$A(t)$ changes according to $m(t)$

' becoz  Ka → Constant
                Ac → Constant
  That's why it is called Amplitude Modulation.

m(t)                                    Message Signal



c(t)                                    Carrier Signal



                                    ← Amplitude changes
                                       according to message
                                                m(t)

S_AM(t)



                Modulated Signal

② Angle Modulation → ∵ c(t) = A Cos(θ(t))

        If θ(t) changes according to message it's called
Angle modulation.   θ(t) → Here two parts →
                          ⌃
(a) Freq. modulation → ωt  (φ)   If ω changes than it's Freq. Mod.
(b) Phase  "   "    →    If φ changes according to m(t) it
                    is  called  Phase modulation.

Q(2) What is the Need of Modulation?

Ans, Modulation is used to transmit Message over a long distance due to the following Reasons→

(1) Practicability of Antennas →

If the comm$^n$ channel is free Space, then Antennas are used to radiate & Receive the Signal. Efficient EM Radiation requires Antennas which to must Height in the same order of Magnitude of wavelength of Signal being X-mitted.

Length of Antenna → $l = \dfrac{\lambda}{4} = \dfrac{c}{4f}$ m)

↳ ✓ If Signal is X-mitted c̄ out modulation then its freq. is order of Hz → 100 Hz Let

$$f = 100\,Hz. \text{ then } l = \dfrac{3 \times 10^8}{4 \times 100}$$

$$= \cdot 75 \times 10^6$$

$$= 750\,Km \text{ which}$$

750 Km length of Antenna is practically Impossible.

↳ After Modulation its freq is of High freq. carrier Signal let's 100 m Hz

$$\text{∴ } l = \dfrac{3 \times 10^8}{4 \times 100 \times 10^6}$$

$$= \cdot 75\,m. \text{ which practicable.}$$

(KB)

(ii) **Multiplexing** → If more than one signals is x-mitted through a single channel, then modulation translates different signals into different spectral location thus enabling the $Rx^2$ to select the desired signal.

(iii) **Overcome equipment limitations** → Modulation is used to convert wide-Band signal to NarrowBand signal. It X-lates the signal to a location in freq. domain where design requirements of filters, Amplifiers, are easily met.

(iii) **Freq. Assignment** → Modulation allows several radio or T.V Stations to Broadcast simultaneously at different Carrier frq. & allow different Receivers to be tuned to select different stations.

(iv) **Reduce Noise & Interference** → In a Comm^n System the effect of Noise & Interference can't be completely eliminated. But should be minimized using certain Schemes. These schemes require a X-mission B-w much larger than the B-w of message Signal. Thus, B-w is traded for Noise reduction.

Q.3) What is Communication System? Explain.
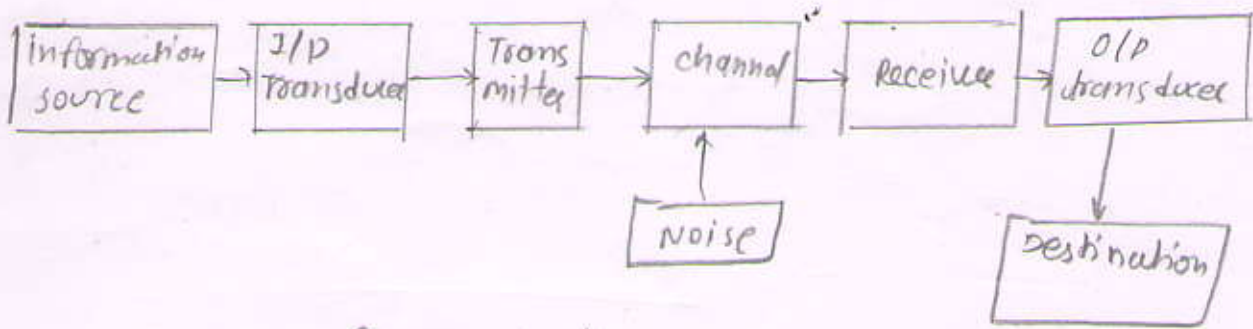


Communication system block diagram

Communication System means a system which is used to transmit information / Message over a long distance properly. For this some devices like X-ducer, Modulator are used.

(i) **Information Source** → Comm^n System X-mitr Message or Information like Voice signal, 2D- Photograph, Digital Video, a data files etc.

(ii) **I/P Transducer** → Transducer converts ~~above~~ electrical Physical Message Signal into electrical Signal.

(iii) **Channel & Noise** → Channel is medium through c̄ our signal is X-mitted., like Coanial Cable, A waveguide, an optical fibre, Radio link.

(iv) **Receiver** → Receiver performs the Inverse of X-mitr to recover original Signal.

(v) **O/p Transducer** → It converts electrical Signal into Original Message.

(vii) **Destination** → It is a unit through which Received Mess. is communicated.