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ANSWER NO 3 (b)

(1) The equations

message equation = $3.5 \cos 5 \times 10^3$ Hz

Carrier equation = $7 \cos 1 \times 10^6$ Hz.

modulated equation = $7(1 + 0.5 \cos 1 \times 10^3 t) \cos 1 \times 10^6 t$

Index = $\frac{Em}{Ec}$

$= \frac{3.5}{7}$

$\boxed{\text{Index} = 0.5}$

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$e_c(t) = 12 \sin \omega t$

$$x_c(t) = \frac{1}{2\pi} \int_{-\omega_c}^{+\omega_c} 12 \sin \omega t$$

$$x_c(t) = \frac{1}{2}\left(\frac{1}{jt}\right) 12 \left(e^{j\omega_0 t} - e^{-j\omega_0 t}\right)$$

$$= \frac{12 \sin \omega_0 t}{t}$$

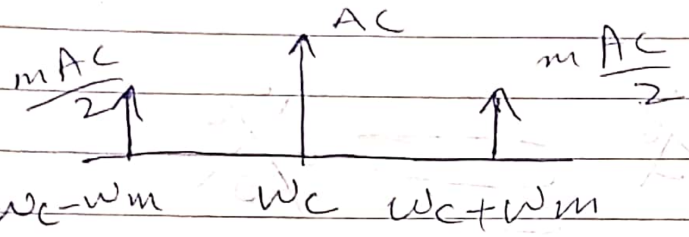
$$x_c(t) = \cos(\omega_0 t) \left[\frac{\sin \omega_0 t}{t}\right].$$

$$X_2(t) = \frac{1}{2} X(w_c - w_m) + \frac{1}{2} X(w_c + w_m)$$

$$X_1(t) = \pi A\,(\delta(w - w_c) + \delta(w + w_c))$$

$$\boxed{X_{AM}(t) = \pi A\left[(\delta(w - w_c) + \delta(w + w_c) + \frac{1}{2}(X(w_c - w_m) + X(w_c + w_m))\right]}$$

Power of AM wave:-



$$X_{AM}(t) = A_c \cos w_c t = m\frac{A_c}{2}\left[\cos(w_c - w_m) + \cos(w_c + w_m)\right]$$

$$X_m(t) = \pi A\left(\delta(w - w_c) + \delta(w + w_c) + \frac{1}{2}\{X(w_c - w_m) + X(w_c - w_m)\right]$$

Power = Power (Lower side band) + P(upper S.B) + P_c

A_c / V_c ~~Am~~ / ~~A~~m

V_c, Rms = $V_c/\sqrt{2}$

V_m, Rms = $V_m/\sqrt{2}$

$$P_c = \frac{V_c^2}{R} \Rightarrow V_c^2/\sqrt{2}R \Rightarrow V^2/2R$$

$$P_m = V_m^2/R \Rightarrow V_m^2\ R \Rightarrow \left(\frac{mV_c}{2}\right)^2 / 2R.$$

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$$= \frac{m^2 V_c^2}{4 \cdot 2R} \Rightarrow m^2 \cdot P_c$$

$$P_t = P_c \left(1 + \frac{m^2}{2}\right)$$

Bandwith $= f_H - f_l$

$$B = (w_c + w_m) - (w_c - w_m)$$

$$\boxed{B = 2w_m}$$

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ANSWER #03 (a)

$X_m(t) = A_m \cos w_m t$
$X_c(t) = A_c \cos w_c t$

$X_{AM}(t) = X_c(t) + X_m(t) \cos w_c t \rightarrow (I)$
$= A_c \cos w_c t + X_m(t) \cos w_c t$.

$$\boxed{X_{AM}(t) = A_c \cos w_c t + \left(1 + \frac{X_m(t)}{A_c}\right)} \rightarrow (II)$$

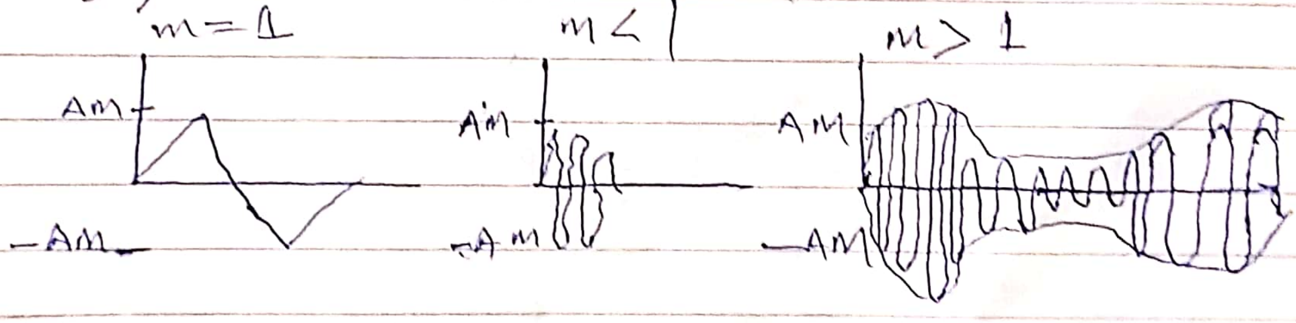
$$X_{AM}(t) = A_c \cos w_c t \left(1 + \frac{A_m}{A_c} \cos w_m t\right) \quad (III)$$

$$X_{AM}(t) = A_c \cos w_c t \left(1 + m \cos w_m t\right)$$

$m \leq 1$ 100% Am

Wave forms for 100% greater than 100% and lower than 100%.

$X_m(t)$



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(7)

ANSWER #02 (b)

AM modulation:-

$$X_m(t) = A_m \cos w_m(t)$$

$$X_c(t) = A_c \cos w_c t$$

$$X_{AM}(t) = A_c[1 + m \cos w_m(t)] \cos w_c(t)$$

$\cos w_c(t)$ multiplied to eq.

$$X_{AM}(t) = A_c \cos w_c(t) + X_m(t) \cos w_c t \rightarrow (1)$$

$$X_{AM}(t) = X_1(t) + X_2(t)$$

As we know that.

$$\cos w(t) = \frac{1}{2}\left[e^{jwt} + e^{-jwt}\right] \rightarrow (2)$$

Comparing eq (1) and eq (2)

$$X_{AM}(t) = \frac{A_c}{2}\left(e^{jwt} + e^{-jwt}\right) + \frac{X_m(t)}{2}\left(e^{jwt} + e^{-jwt}\right)$$

$$x_m(t) e^{jw_c t} \longrightarrow X(w_c - w_m) \quad (3) \text{ eq}$$

$$X_m(t) e^{-jw_c t} \longrightarrow X(w_c + w_m)$$

The eq (3) becomes

$$X_{AM}(t) = \frac{1}{2} X_m(t) e^{jw_c t} + \frac{1}{2} x_m(t) e^{-jw_c t}$$

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ANSWER #02 (A).

(i) $5 \cos 2\pi 10^6$

(ii) $3 \cos 2\pi 10^3$

(i) $f_1 = 2 \times 10^6$

Sol:-

$$\lambda = \frac{c}{f_1}$$

c = speed of light.

$$\lambda = \frac{3 \times 10^8}{2 \times 10^6}$$

$$\lambda = \frac{3}{2} \times 10^{8-6}$$

$$\lambda = \frac{3}{2} \times 10^2$$

$$\boxed{\lambda = 1.5 \times 10^2 m \text{ Ans}}$$

(ii) $f_2 = 2 \times 10^3$

$$\lambda = \frac{c}{f_2}$$

$$\lambda = \frac{3 \times 10^8}{2 \times 10^3}$$

$$\boxed{\lambda = 1.5 \times 10^5}$$

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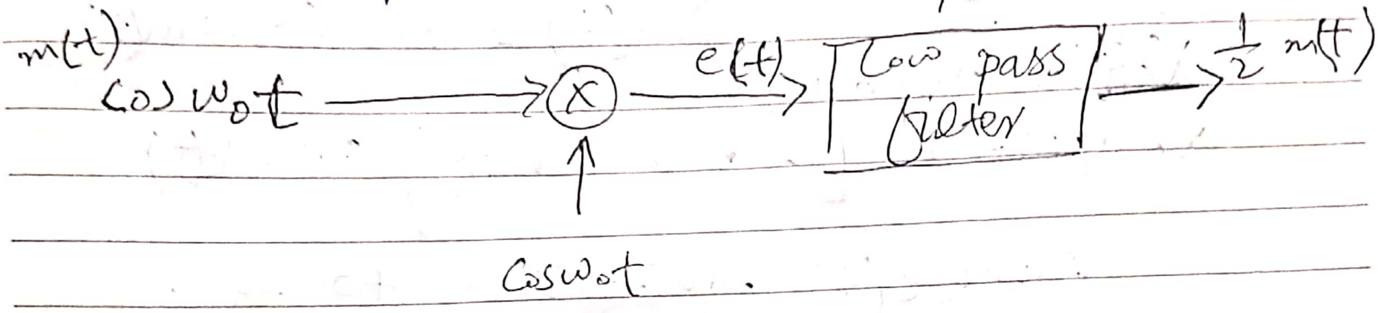
ANSWER #01 (e)

$$f(t) = c\cos(\omega_0 t + \theta)$$



$$\therefore f(t) = m(t)\cos^2\omega_0 t$$

$$f(t) = m(t)\left\{\frac{1+\cos(2\omega_0 t)}{2}\right\}$$

$$f(t) = \frac{m(t)}{2} + \frac{m(t)\cos(2\omega_0 t)}{2}$$

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ANSWER #01 (c)

The baseband signal are incompatible for direct transmission. For such signal to travel longer distance its strength has to be increased by modulating with high frequency carrier wave which doesn't effect the parameters of modulating signal.

ANSWER #01 (d)

Digit signals are not preffered for communication over wireless communication channel

Digital signal:-

(1) Digital signal can be transmitted over long distance.

(2) It repeatl and regenerate signal before simplify them.

(3) Distorted & noisy signals can be recovered without error.

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(3) Channel:-

Channel is a physical medium which connects transmitter with receiver.

(4) Receiver:-

Receiver converts the signal back into readable message.

(5) Destination:-

Destination receives the message signal and process it to comprehend the information present in it.

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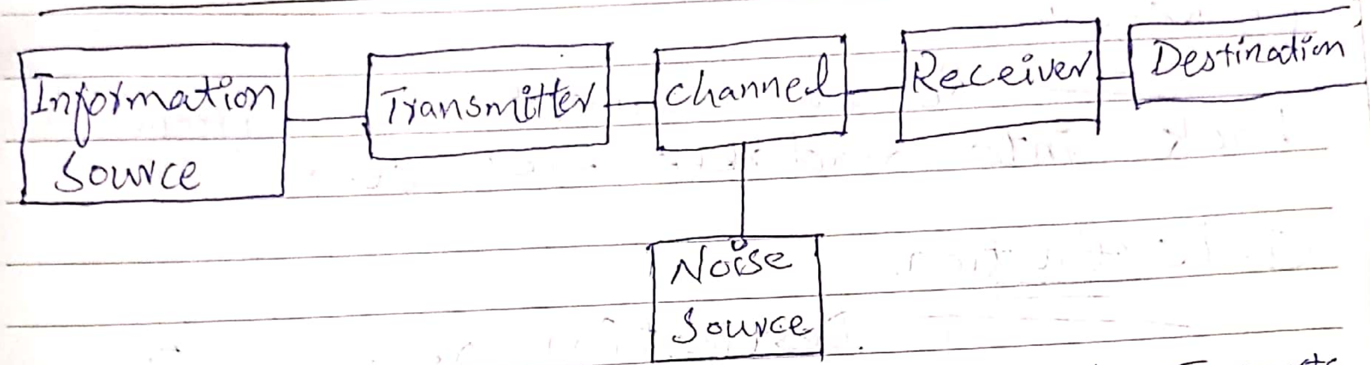
ANSWER #01 (b)

Block diagram:-



communication system consists of 5 parts which are given below.

① Information Source:- Information is a very genetic word signifying at the abstract level anything intended for communication, which include some thoughts, news, feelings and information source converts this information into physical quantity.

② Transmitter:- Transmitter block collect the incoming signal and modify it, such that it can be transmitted from choosen channel to receiving point. channel is a physical medium which connects transmitter with receiver.

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ANSWER No1 (a)

SNR:-

Signal to noise ratio.
A high quality communication requires a high SNR. SI unit of SNR is decible (dB)

$$SNR = \frac{\text{power of signal}}{\text{power of Noise}}$$

For example:-

$C = B \log_2 (1+SNR)$.
where C is the channel capacity.

SNR = 20dB.
Bandwith = 4KZ.
channel Capacity = ?

solution:-

$C = B \log_2 (1+SNR)$
putting values

$SNR = 10 \log_2(100)$
$= 10 \times 2$
$SNR = 20dB$

$C = 4 \times 10^3 \times \log_2 (1+100)$
$C = 4 \times 10^3 \times \log_2 (101)$
$C = 4 \times 10^3 \times 6.65$
$\boxed{C = 26.60K \text{ bits/sec}}$