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Set B -

~~Ans 1~~

Ans 1 Power of AM -

$P_t = P_c + P_{USB} + P_{LSB}$

$P_c = \frac{A_c^2}{2R}$ $P_{USB} = \frac{(A_c\mu/2)^2}{2R}$ $P_{LSB} = \frac{(A_c\mu/2)^2}{2R}$

Now Substituting above values in

$$P_t = \frac{A_c^2}{2R} + \frac{\mu^2 A_c^2}{8R} + \frac{\mu^2 A_c^2}{8R}$$

$$P_t = \frac{A_c^2}{2R} + \frac{\mu^2 A_c^2}{4R}$$

$$\boxed{P_t = P_c + \frac{\mu^2 P_c}{2}}$$

Ans 2 - Advantages are as follows

1- Only one Side Band is transmitted ∴ Reduction of Transmitter Power takes place.

2:- Since ~~only~~ it consists of only one side band reciever bandwidth can be reduced by Half. This will improve the Signal to Noise ratio by a factor of two i.e. 3db

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Ans 3 -

Direct Method	Indirect Method
(1) The carrier frequency is directly varied in accordance with the input signal (baseband)	The modulating signal is used to produce NBFM signal
(2) Parametric variation method is used in direct method in which frequency is varied according to the message signal x(t).	Armstrong method is used in indirect method

Ans 4 -

The deviation ratio can be defined as the change in the frequency of the carrier signal (s(t)) to the modulating frequency

$$D = \frac{\text{Maximum frequency Deviation}}{\text{Max Modulating freq.}}$$

Ans 5 -

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Ans 6
Power Spectral Density (PSD) is the measure at Signal's Power Content versus frequency. The PSD for white noise is Constant for all frequencies Ranging from $-\infty$ to ∞.

Ans 7 - Sampling is defined as the process of measuring the instantaneous value of Continuous time Signal in a ~~So~~ discrete form.

The different types of Sampling are
(i) Impulse Sampling
(ii) Natural Sampling
(iii) Flat to top Sampling

Ans 8 - Factors are as follows -

The transmission bandwidth of a PCM is given by

$$BW \geq \gamma/2$$

Where γ is a ~~So~~ Sampling rate

$$\gamma = \nu f_s$$

$$BW \geq \frac{\nu f_s}{2}$$

$$BW \geq \frac{\nu \cancel{f_s} 2 f_m}{\cancel{2}}$$

$$\Rightarrow \nu f_m$$

$\therefore$ BW depends upon the frequency of message Signal and ν is a no. of bits

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AS No. of bits increases the Bandwidth of a ~~Sr~~ PCM ~~to~~ system will increase.

Ans - The threshold may be defined as the Minimum (SNR) output Ratio upto which below which signal to noise ratio sta Starts degrading very fast giving erro error in a ~~trans~~ noise performance of a device.

~~Ans 8~~

An 9 - Among All according to me ASK is a better technique because it is more Susceptible to noise so it have a higher BER for a given Modulation.

An 10 - The different types of line Coding are:-

(i) Unipolar NRZ
(ii) Unipolar RZ
(iii) polar NRZ
(iv) Polar RZ
(v) Bipolar NRZ
(vi) Split Phase Manchester.

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Q II (a)

Ans (a) - In Delta Modulation, System transmit one bit per Sample and that bit is compared with the ~~prev~~ previous sample, if the sample is increasing then 1 is alloted otherwise 0 is alloted, ∴ DM system increases or decreases ~~sol~~ stepwise to show the changes

Let the input Signal be ~~$x(nT_s)$~~ $x(t)$
and Approximated Signal be $\hat{x}(nT_s)$

∴ Error is given by

$$e(nT_s) = x(nT_s) - \hat{x}(nT_s)$$

$e(nT_s)$ = Error Signal
$x(nT_s)$ = Sampled Signal
$\hat{x}(nT_s)$ = last Sample approximation

if we assume $u(nT_s)$ as present Sample and $u[(n-1)T_s] = \hat{x}(nT_s)$

So $b(nT_s) = \Delta \, \text{Sign}\{e(nT_s)\}$

$$\text{if} \begin{cases} +\Delta & x(nT_s) \geq \hat{x}(nT_s) \\ -\Delta & x(nT_s) \leq \hat{x}(nT_s) \end{cases}$$

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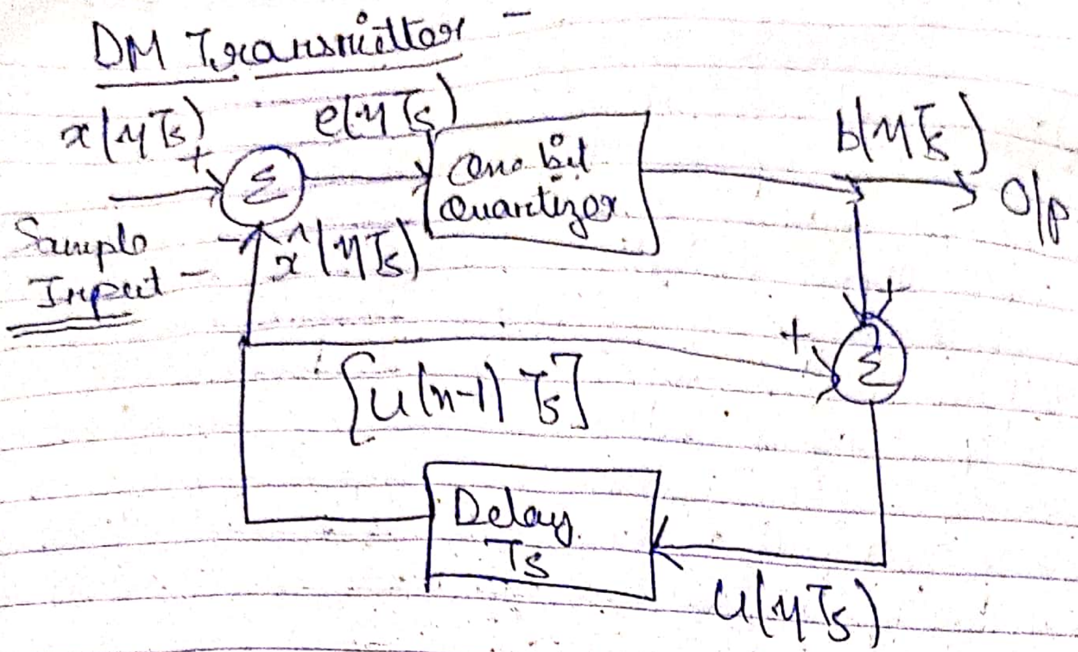
DM Transmitter -



$$u(nT_s) = u(n-1)T_s + [\pm\Delta]$$

Delta Modulation has two Drawbacks :-

(i) Slope overload Distortion: When the rate of rise of Input Signal is so high the uniform step size is not able to approximate it ∴ Slope overload Distortion is created

(ii) Granular Noise -
When the rate of Rise of Signal is quite low compared to step size Δ it will create Granular Noise

To overcome this in Adaptive Delta Modulation we vary the step size to get the ~~error~~ according to the input Signal ∴ Adaptive ~~Delta~~ Delta Modulation is non uniform Quantization.

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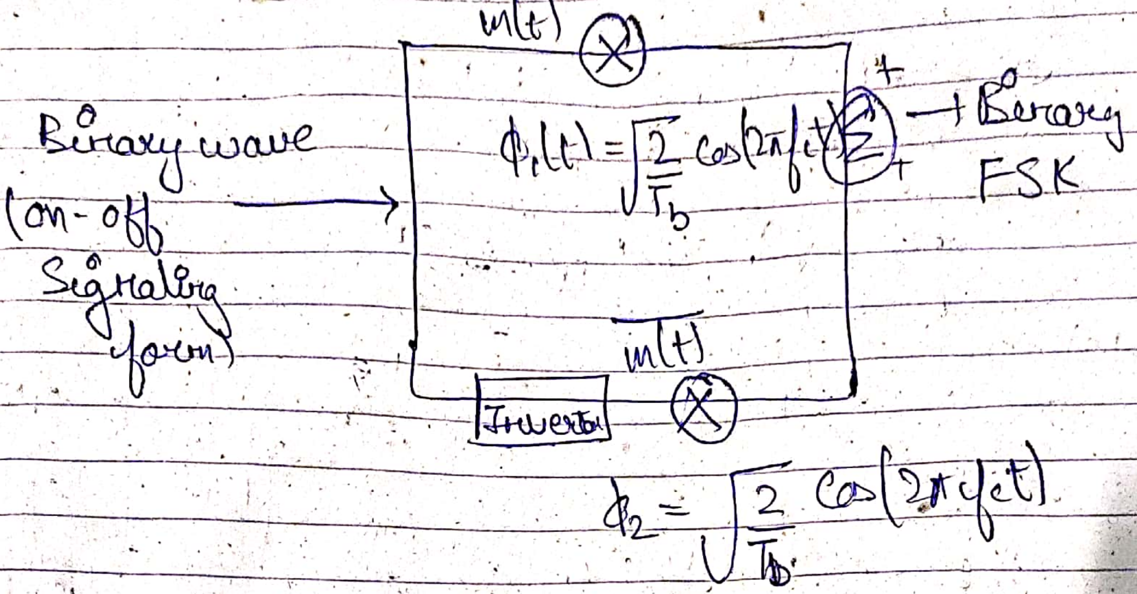
Ans 18(b)

~~Ans 18(b)~~ 1 To generate a binary FSK Signal we will



2 The input binary sequence is represent in its on-off form, with Symbol 1 represented by Constant Amplitude $\sqrt{E_b}$ Volts and symbol 0 represented by 0 Volts

3 - By using an inverter in the lower channel when symbol 1 is present at the input, the oscillation with frequency f_1 in the upper channel is switched on ~~white~~ while f_2 in lower Channel is switched off

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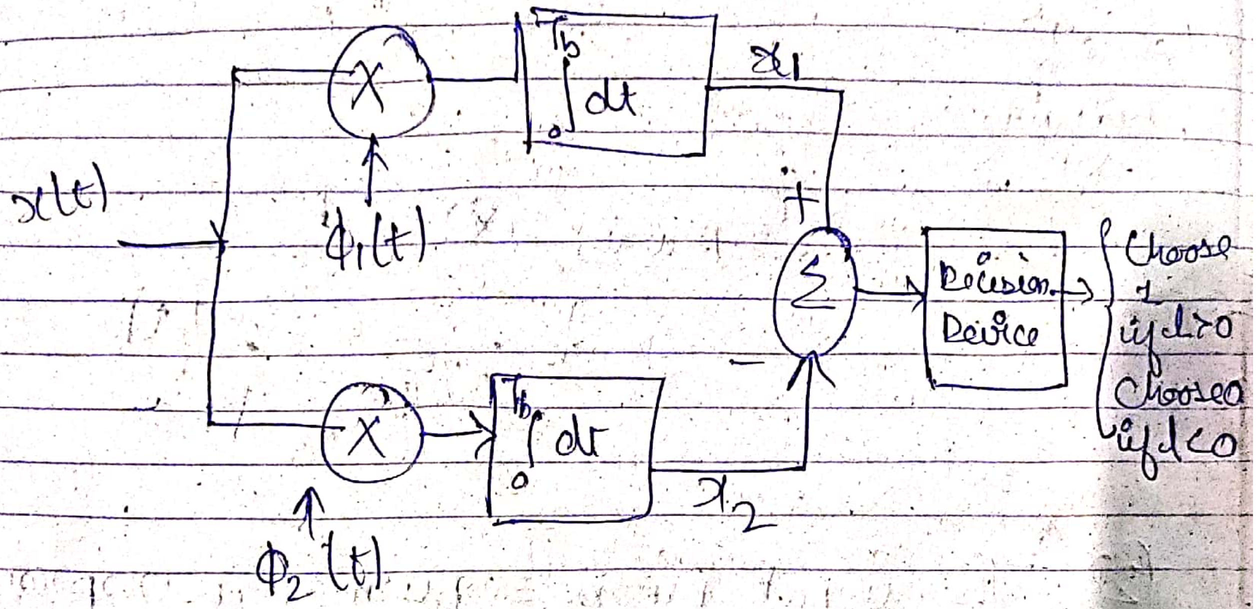
f_1 and f_2 are equal multiples of the bit rate $1/T_b$

Coherent binary FSK Detection



- In order to detect the original binary sequence given, the noisy received wave $x(t)$ at the receiver is shown above.

It consists of 2 correlations with a common input, which are supplied with locally generated coherent reference signals $\phi_1(t)$ and $\phi_2(t)$.

The correlation outputs are then subtracted one from the other, & the resulting difference l is compared with the threshold of zero volts

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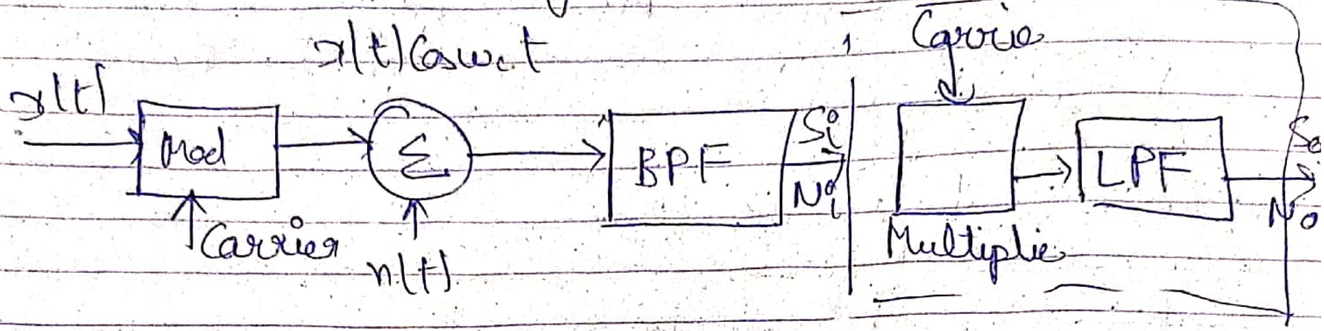
Ques 20 (b)

Noise Calculation for DSB-SC System



For Input Signal

$$s(t) = x(t) \cos \omega_c t$$

S_i = Mean Square value of $s(t)$

$$= \frac{1}{2\pi} \int_{-\infty}^{\infty} x^2(t) \cos^2 \omega_c t \cdot dt$$

$$= \frac{1}{2\pi} \int_{-\infty}^{\infty} x^2(t) \left[\frac{1 + \cos 2\omega_c t}{2} \right] dt$$

$$\Rightarrow \frac{1}{2\pi} \int_{-\infty}^{\infty} \frac{x^2(t) \cdot dt}{2} + \frac{1}{2\pi} \int_{-\infty}^{\infty} \frac{x^2(t) \cos 2\omega_c t \cdot dt}{2}$$

$$S_i = \frac{1}{2} \overline{x^2(t)}$$

(ii) Input Noise Power -

$$n_i(t) = n_c \cos \omega_c t - n_s(t) \sin \omega_c t$$

$$N_i = \frac{1}{2} \overline{n_i^2(t)} = \frac{1}{2} \overline{n_c^2(t)} = \frac{1}{2} \overline{n_s^2(t)}$$

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(iii) Out put Signal Power

$e(t) = x(t) \cos\omega_c t \cdot \cos\omega_c t$

Due to Synchronous Detector Carrier is Multiplied

$e(t) = x(t) \cos^2\omega_c t$

$e(t) = x(t) \left[\frac{1+\cos 2\omega_c t}{2}\right]$

$e(t) = \frac{x(t)}{2} + \frac{x(t)\cos 2\omega_c t}{2}$

Since it Pass through LPF

$e(t) = \frac{x(t)}{2}$

So RMS value

$= \frac{1}{2}\left[\frac{1}{2}\overline{x^2(t)}\right]$

$= \frac{1}{4}\overline{x^2(t)}$

(iv) Out put Noise Power

$n(t) = n_c(t) \cos\omega_c t - n_s(t) \sin\omega_c t$

Due to detector Carrier is Multiplied

$n_d(t) = \left[n_c(t) \cos\omega_c t - n_s(t) \sin\omega_c t\right] \cos\omega_c t$

$= n_c(t) \cos^2\omega_c t - n_s(t) \sin\omega_c t \cos\omega_c t$

$n_c(t)\left[\frac{1+\cos 2\omega_c t}{2}\right] - \frac{n_s(t)}{2}$

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After Passing thru LPF

$n_d(t) = \frac{1}{2} n_c(t)$

So RMS value

$N_o = \frac{1}{2}\left[\frac{1}{2}\overline{n_c^2(t)}\right]$

$= \frac{1}{4}\left[n_c^2(t)\right]$

Figure of Merit for DSB-SC Signal

$$\gamma = \frac{S_o/N_o}{S_i/N_i} = \frac{\frac{1}{4}\overline{x^2(t)}}{\frac{1}{4}\overline{n_c^2(t)}} \times \frac{\frac{1}{2}\overline{n_c^2(t)}}{\frac{1}{2}\overline{x^2(t)}}$$

$$\boxed{\gamma = 1}$$

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Ans 16 (a) -

$BW = 4.2 \times 10^6 \, Hz$

$L = 512$

$L = 2^v$

$v = L = 512$

$512 = 2^v$

$v = 2^9 \quad \boxed{v = 9}$

(i) No. of bits = 9

(ii) Transmission BW

$BW \Rightarrow \frac{r}{2}$

$BW = \frac{v f_s}{2}$

$\Rightarrow \frac{9 \times 2 f_m}{2}$

$\Rightarrow \frac{9 \times \cancel{2} \times 4.2 \times 10^6}{\cancel{2}}$

$\Rightarrow 37.8 \times 10^6 \, Hz$ (Ans)

(iv) $\Rightarrow \frac{S}{N} = (4.8 + 3.2 v)$

$\frac{S}{N} = (4.8 + 3.2 \times 9)$

$\frac{S}{N} = (4.8 + 28.8)$

$\frac{S}{N} = 33.6$

(iv) $\left(\frac{S}{N}\right) \le (4.8 + 6v)\, db$

$\left(\frac{S}{N}\right) \le (4.8 + 6 \times 9)\, dB$

$\le (58.8)\, dB$ (Ans)

(iii) $r = v f_s$

$r = 9 \times 2 \times 4.2 \times 10^6 \, Hz$

$r = 80.2 \times 10^6 \, Hz$

(iii) Ans//