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SMCN

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① Carrier signal

$c(t) = C(\sin 2\pi f_c t + \phi_c)$ ... ①

② $s(t) = S \sin(2\pi f_{sm} t)$ ... ②

where $s(t)$ = Music signal

f_{sm} = Music signal Maximum frequency = 20 KHz

③ Let Amplitude modulated signal be

$$m_a(t) = \{C + k_a s(t)\} \sin(2\pi f_c t + \phi_c)$$

Here Amplitude of carrier varied according to the instantaneous value of the music signal $s(t)$, and f_c & ϕ_c = Constant

Assume $\phi_c = 0$

$$m_a(t) = (C + k_a s(t)) \sin 2\pi f_c t$$

$$= (C + k_a S \sin 2\pi f_{sm} t) \sin 2\pi f_c t$$

$$= C \sin 2\pi f_c t + k_a S \sin 2\pi f_{sm} t \times \sin 2\pi f_c t$$

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$\Rightarrow m_a(t) = \underline{C \sin 2\pi f_c t}$

$+ \frac{K a S}{2} \underline{2 \sin\phi \sin\theta}$

where $\phi = \underline{2\pi f_c t}$

$\theta = 2\pi f_{sm} t$

$\Rightarrow m_a(t)$

$= \underbrace{C \sin 2\pi f_c t}_{\text{Carrier}}$

$+ S' \{ \cos(\phi - \theta) - \cos(\phi + \theta)$

where $S' = \frac{K a S}{2}$

$\Rightarrow m_a(t) = C \sin 2\pi f_c t$

$+ S' \cos(2\pi(f_c - f_{sm})t$

$- S' \cos(2\pi(f_c + f_{sm}$

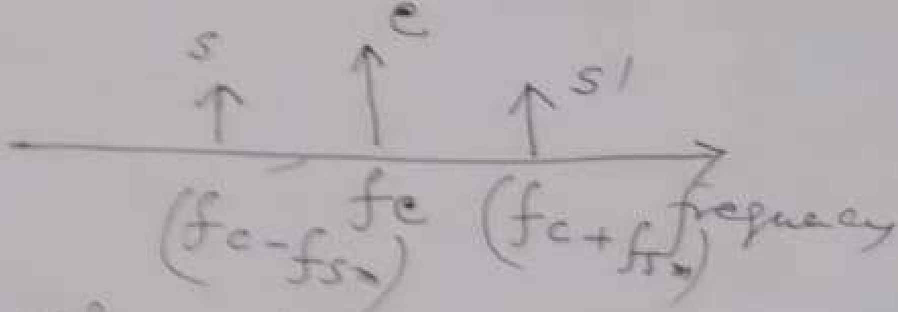
$= C \sin 2\pi f_c t$

$+ S' \sin(2\pi(f_c - f_{sm})t +$

$+ S' \underline{\sin}(2\pi(f_c + f_{sm})t +$

Σ Time domain representation of IT modulated signal.

① ⇒ Frequency domain representation of the modulated signal



where fsm = 20 KHz

② So Bandwidth of the modulated signal m(t)

$= (fc+fsm) - (fc-fsm)$

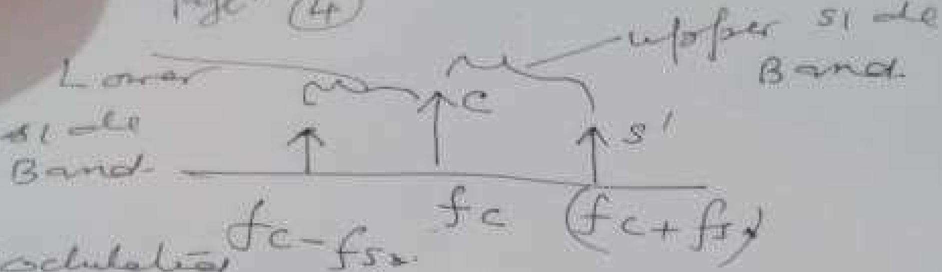
$= 2fsm$ = BW of the channel

③ Bandwidth of the original signal = fsm.

④ So Bandwidth of the channel

= 2 × BW of the music signal

(1)



In Modulation signal m(t)

(2) (fc - fsm) to (fc + fsm)

Preserves the charactenstics of the signal fsm ~~but~~ along with the corner.

(3) Demodulation:

Elliminating the corner signal fc from (2) of the modulation and geeting back fsm —
But BW = 2 fsm.

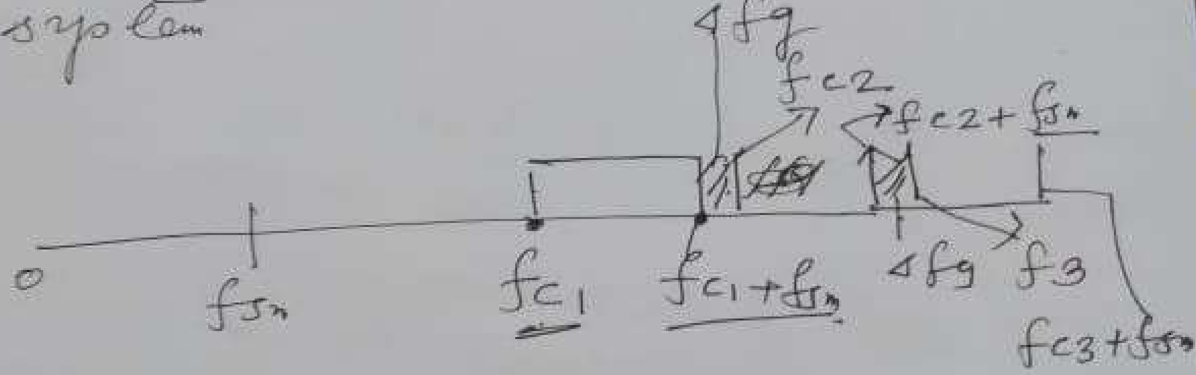
(4) from upper side band also we can do demodulation:

fc to (fc - fsm)
Ellemate the corner fc
and we get back fsm. —
But BW required = fsm only
But some loss of quality.

(5) we can do demodulation from the Lower side Band also with some Loss quality

1. Therefore with Loss of some quality, instead of ~~sending~~ transmitting the whole of $m(t)$ we can send the upper side band or the Lower side band and demodulate the ~~ab~~ receiver end.

2. Assume we always send the upper side band in FDM system



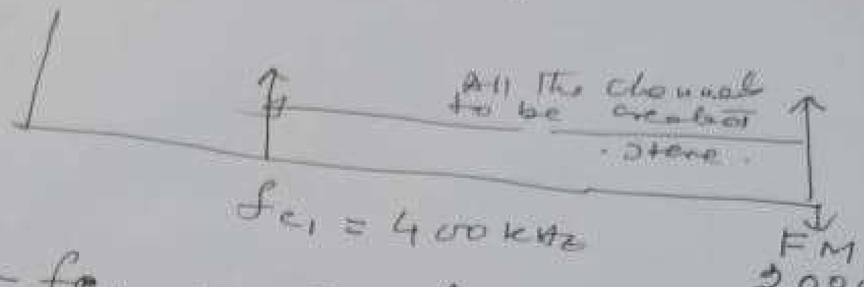
(3) Assume in a FDM system of Music Transmission f_{c1} = Lowest Carrier = 400 KHz

f_{sm} = Bandwidth of the music signal = 20 KHz

Guard Band = 2 KHz.

Highest frequency of the Medium = f_M = 2 MHz

(4) (06) Calculate How many channels n can be created using FDM?



$$FM - f_{c_1} = \underbrace{n \times f_{sm}}_{n \text{ channels.}} + \underbrace{(n-1)\,\Delta f_g}_{(n-1) \text{ guard bands.}}$$

$$2000 - 400 = n \times 20 + (n-1) \times 2$$

$\Rightarrow$ Calculate n

and take the floor value of n. (Round off to lower integer.