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SMCN

signal transmission over space → ① Analog, ② Digital

① (i) Analog voice :- Music — 0 - 20 kHz
— Telephone — 0 → 4 kHz

(ii) TV → — Video — 0 - 5 MHz
— Audio — Audio Music 0 - 20 KHz.

② Digital signal transmission — we shall discuss later.

③ Analog Music transmission over space:

Say we have n number of sources:

		BW	
S_1	→	0 — 20 KHz	Low pass signal.
S_2	→	0 — 20 KHz	
⋮			
S_n	→	0 — 20 KHz.	

④ When all sources transmit Their music signal all will collide in the space.

(5) Signals
- → Low pass (Music) 0 – fe
- → band pass – f_L – f_H (Modulated signal)
- → High pass – f_H → ∞ ×

(6) Solution:

Low pass Music signal 0 – fe, C = 20 KHz → Modulator → ~~Band~~ Band pass Modulated signal

↑ Carrier frequency fc

(7) Modulation types
- (i) Amplitude Modulation (AM)
- (ii) Frequency Modu (FM)
- (iii) Phase Modulation (Not used)

(8) (i) Amplitude Modulated Music:

← Band pass signal
fc → fc + 20 KHz
Band width of each channel

(ii) 0 – 20 KHz Low pass signal is transformed to fc → fc+20 KHz Band pass signal.

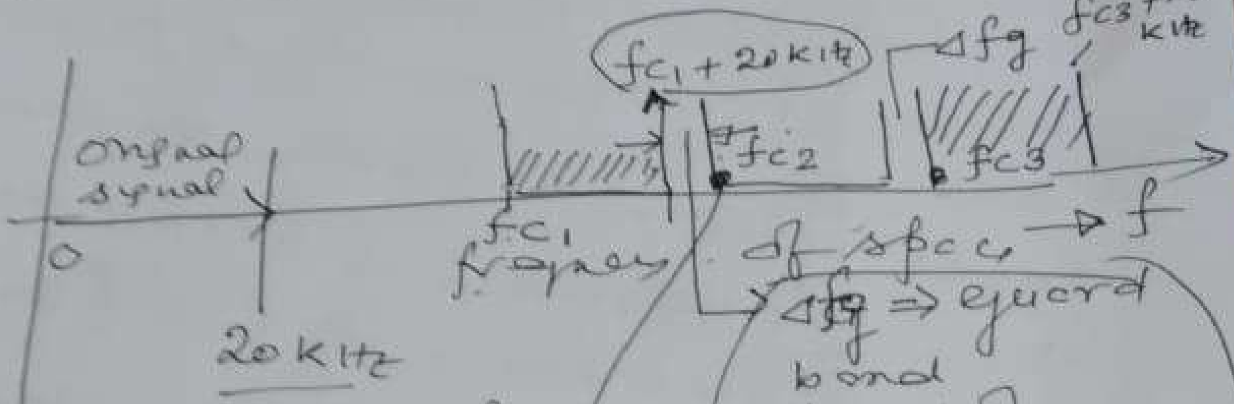
~~Frequency~~ Modu

(9) Frequency Modulation:

0 → 20 kHz Low pass signal

transformed to f_c to $(f_c + 5 \times 20\ \text{kHz})$ Band pass signal by Frequency modulation.

10. Frequency Division Multiplexing in AM Music transmission



$\Delta f_g \Rightarrow$ guard band to stop interference between two consequitive channels

$f_{c2} = f_{c1} + 20\ \text{kHz} + \Delta f_g$

$f_{c3} = f_{c2} + 20\ \text{kHz} + \Delta f_g$

$f_{c4} = f_{c3} + 20\ \text{kHz} + \Delta f_g$

(11) Each Low pass Music signal 0 - 20 kHz $\Rightarrow$ Band pass Music signal $f_c \to f_c + 20\ \text{kHz}$ By Modulation.

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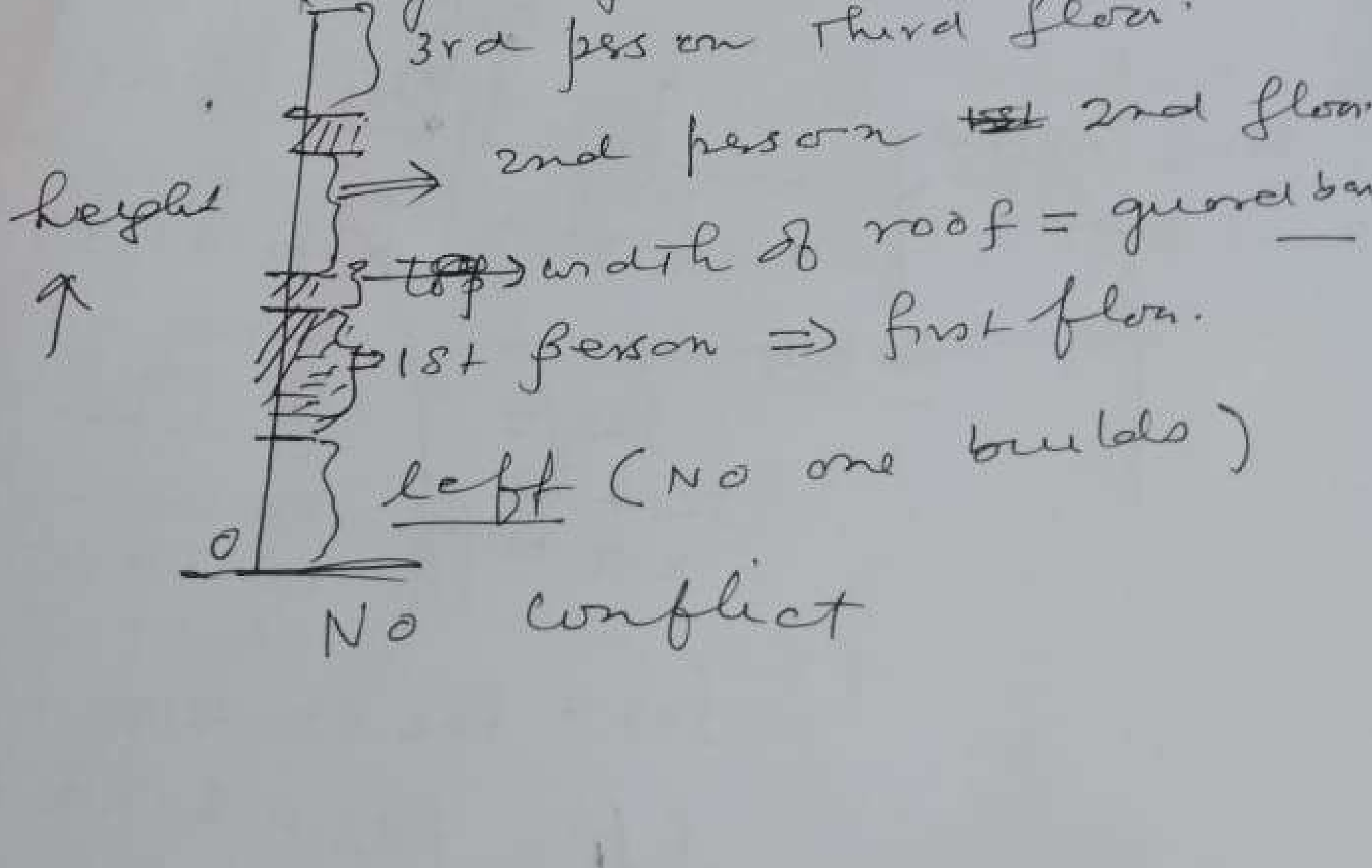
(01) Storie Building Analogy with Modulation

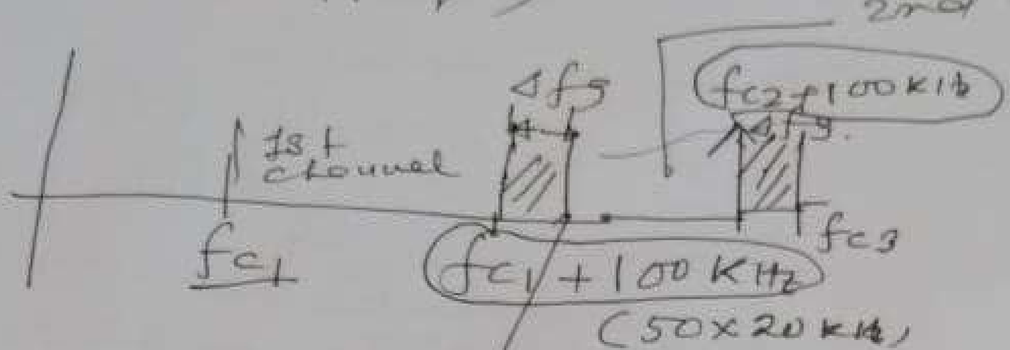
one one piece of Land in ground floor. N number of parties want to build ground floor $\Longrightarrow$ Conflict.

(02) Each builds Their house in multistoried fashion leaving ground floor.



No conflict

(01) Frequency division multiplexing (FDM) for Frequency Modulation



$f_{c2} = f_{c1} + 100kHz\ (5\times 20\ kHz) + \Delta f_g$

$f_{c3} = f_{c2} + 100kHz + \Delta f_g$.

⋮

(02.) signal $\rightarrow$ Modulation $\rightarrow$ $m(t)$ = Modulated signal.

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

$= S\sin 2\pi f_{sm}t$

$\downarrow$

Maximum signal in Music $= 20\,kHz$

Carrier signal $\uparrow$

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

3) AM

$m(t) = (C + k_a s(t))$

$\sin(2\pi f_c t + \phi_c$

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(04) Frequency Modulation

If $m(t) = c \sin(2\pi (f_c + k_f s(t))t + \phi_c)$

c and ϕ_c constant, f_c varies.

(05) Phase Modulation.

$m(t) = c \sin(2\pi f_c t + (\phi_c + k_p s(t)))$

c and f_c constant, ϕ_c varies

ka = proportionality constant for Amplitude modulation.

kf = proportional constant for frequency modulation.

kp = proportionality constant for phase modulation.