First Exam.

Subject : 7 / 3 / 2017.

* why ~~the~~ to modulate a signal ?

1) to reduce the effective length of the used antennas.

2) to allocate a unique frequency range for each application.

AM :- 540 kHz → 1600 kHz.
FM :- 88 MHz → 108 MHz.
T.V :- 52 MHz → 88 MHz.
mobile Communication :- 900 MHz
1800 MHz.
2100 MHz.

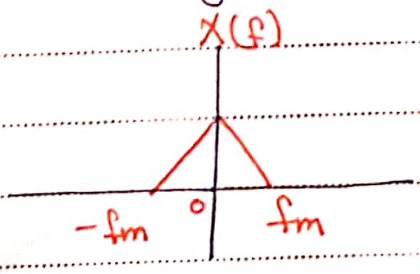
* كلما زادت ال frequency بتقل طول ال antenna.

* * *

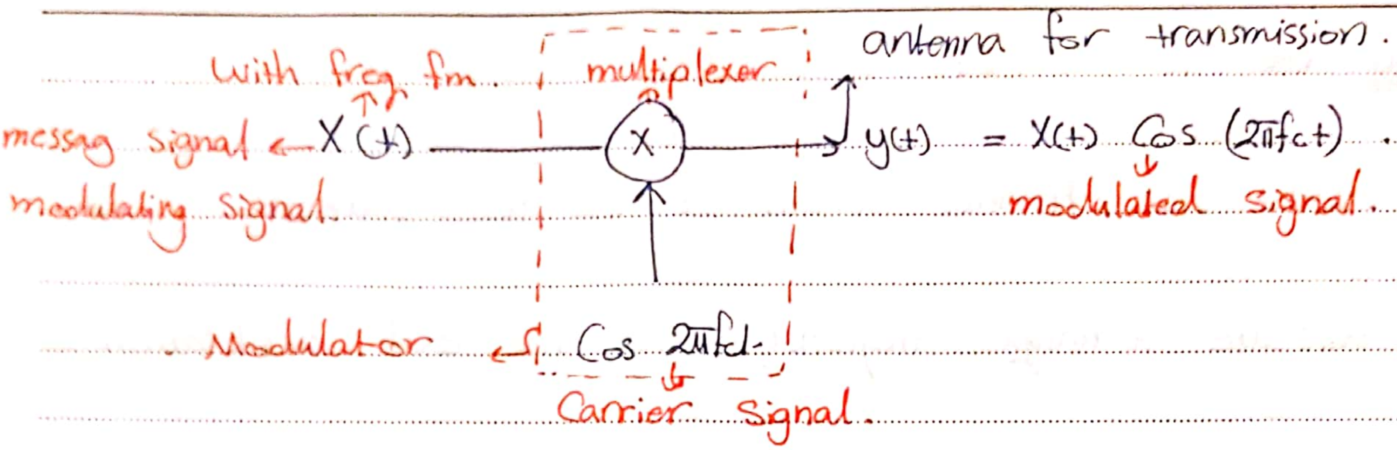
Amplitude modulation :- (12 - 3 - 2017)

Voice : 0 → 4 kHz.
AM : 540 kHz → 1600 kHz.

let we have a signal $x(t)$ with fourier transform $X(f)$, where the signal $X(f)$ is given by :-



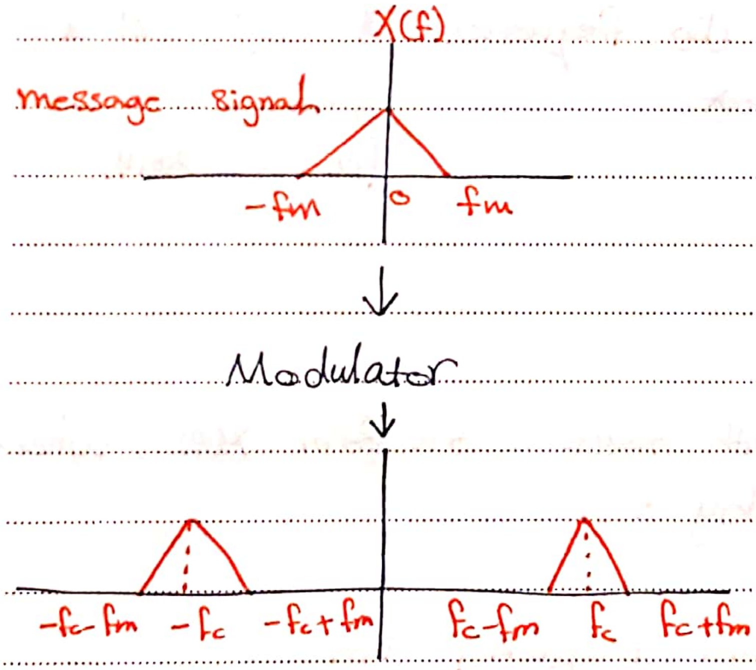
→ signal with frequency fm.



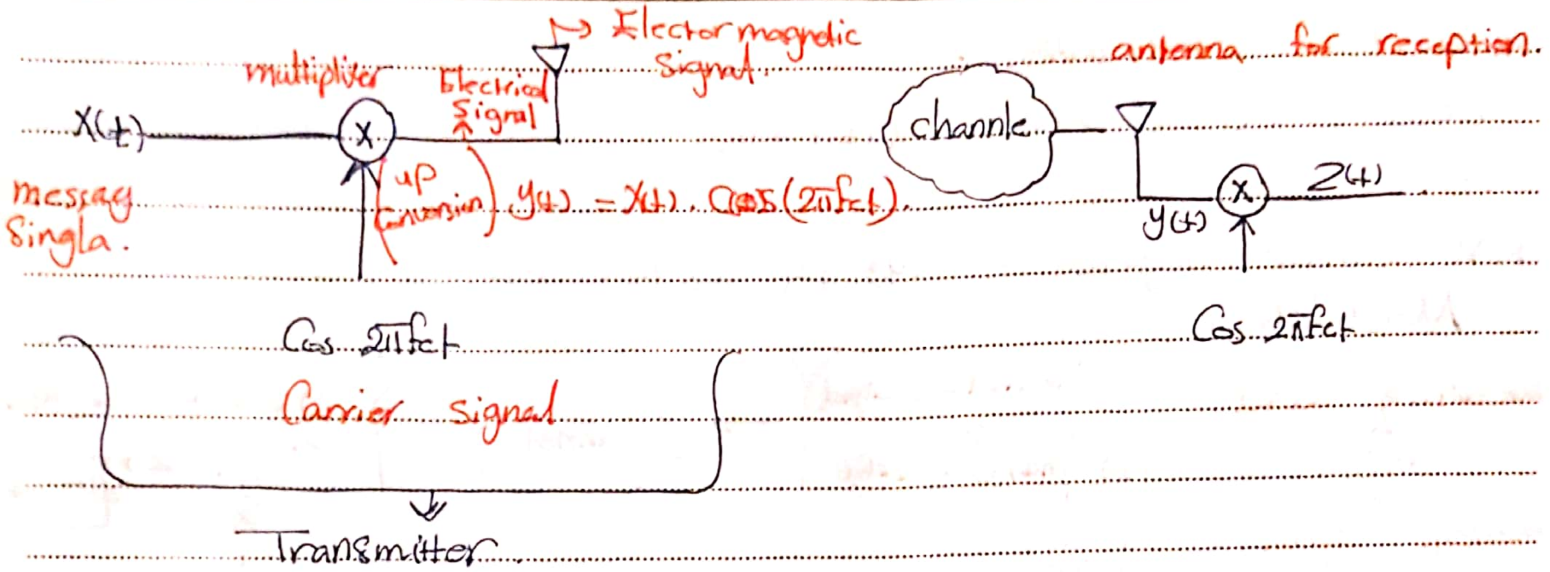
$$\therefore \; y(t) = \frac{1}{2} x(t) \left[e^{j2\pi f_c t} + e^{-j2\pi f_c t} \right]$$

$$Y(f) = \frac{1}{2} F \left\{ x(t)\, e^{j2\pi f_c t} + x(t)\, e^{-j2\pi f_c t} \right\}$$

$$= \frac{1}{2} X(f-f_c) + \frac{1}{2} X(f+f_c)$$



modulated signal.



$$\therefore Z(t) = y(t) \cdot \cos(2\pi f_c t)$$

$$= X(t) \cdot \cos(2\pi f_c t) \cdot \cos(2\pi f_c t)$$

$$= X(t) \left[\frac{1}{2} + \frac{1}{2} \cos 4\pi f_c t \right].$$

$$= \frac{1}{2} X(t) + \frac{1}{2} X(t) \cos(4\pi f_c t).$$

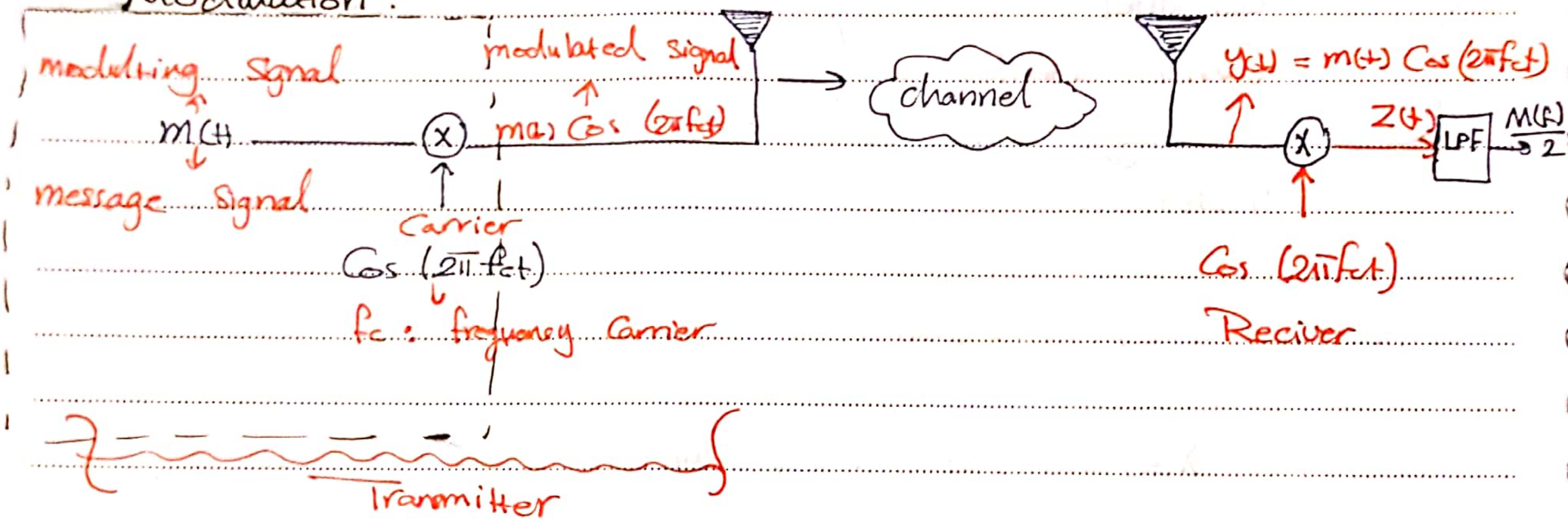
Subject : DSB - SC   14 / 3 / 2019.

* amplitude modulation :-

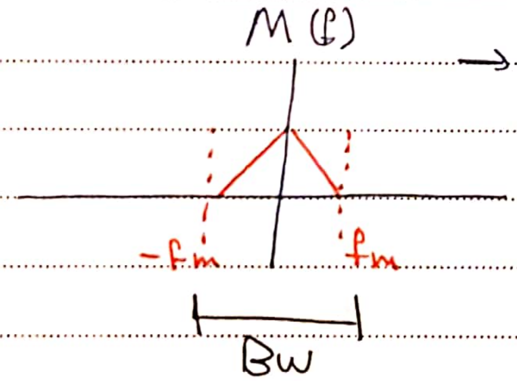
Voice : 0 → 4 kHz (3.4 kHz)

AM carrier frequency :- 540 kHz → 1600 kHz.

Modulation.



channel :- medium between a transmitter and destination.



→ message m(t) with fourier transform M(f).

→ BW = 2Fm ⟹ DSB

Reciver في يتم demodulatino عليه *

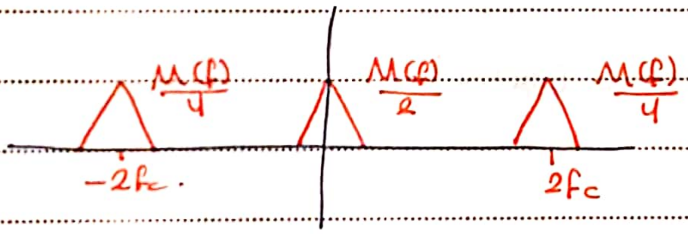
Subject : 14/3/2019.

$$Z(t) = y(t)\cos(2\pi f_c t)$$
$$= m(t)\cos(2\pi f_c t)\cdot\cos(2\pi f_c t)$$
$$= m(t)\cos^2(2\pi f_c t)$$
$$= \frac{m(t)}{2}\left(1 + \cos 4\pi f_c t\right)$$

$$= \frac{m(t)}{2} + \frac{m(t)}{2}\cos(4\pi f_c(t)).$$

$$\therefore Z(f) = \underbrace{\frac{M(f)}{2}}_{}\!\!\;^{\text{message signal}} + \frac{1}{4}M(f+2f_c) + \frac{1}{4}M(f-2f_c).$$

له الجزء الوحيد اللازم هو $\frac{M(f)}{2}$ لذلك نستخدم LPF عشان نشيل الباقي .



$$Z(t) = \frac{m(t)}{2} + \frac{m(t)}{2}\cos(4\pi f_c t).$$
$$= \frac{m(t)}{2} + \frac{m(t)}{4}\left(e^{j4\pi f_c t} + e^{-j4\pi f_c t}\right).$$

$$\therefore Z(f) = \frac{M(f)}{2} + \frac{1}{4}\left(M(f-2f_c) + M(f+2f_c)\right).$$

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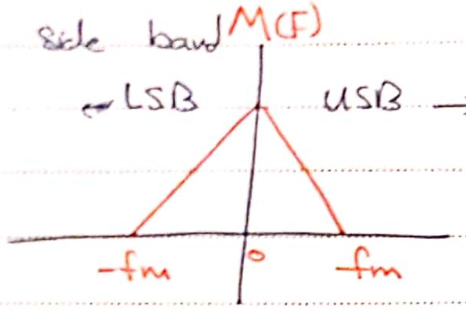
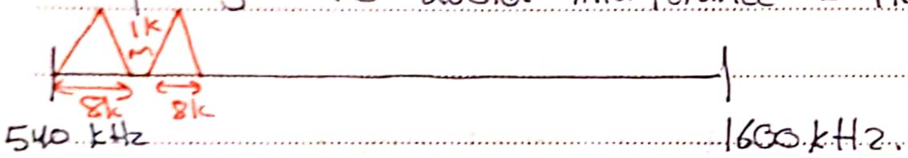
Subject : 14 / 3 / 2019

lower side band ← LSB | USB → upper side band



in AM , $BW = 2f_m = 2(4k) = 8kHz$.

↳ gab to avoid interferance = 1kHz.



لو × في AM يكون ال BW للاشارة 8kHz ، و يوجد gab بمقدار 1kHz.

$m(t) \longrightarrow \otimes \longrightarrow y(t) = m(t) \cdot \cos(2\pi f_c t)$.

$\uparrow \cos(2\pi f_c t)$

$|\Psi_y(f)| = ?! \quad |Y(f)|^2$.

$$Y(f) = \frac{M(f - f_c)}{2} + \frac{M(f + f_c)}{2}$$

$$\Psi_g(f) = |Y(f)|^2 = \frac{1}{4}|M(f-f_c)|^2 + \frac{1}{4}|M(f+f_c)|^2$$

↳ energy spectral density of the modulated signal (ESD).

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