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Section: 'A'
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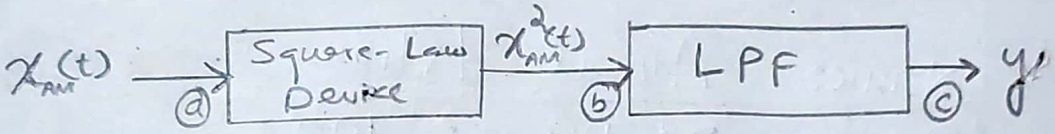
Communication Systems
Assignment # 2nd.

Question # 1:

Analyze the square law detector shown in the figure bellow. Draw and write the necessary figures and expressions for $x_{AM}(t)$, $x^2_{AM}(t)$, y. Assum at the input of detector is DSB+C applied.



Solution:

The signal at point a is $[A+m(t)]\cos\omega_c t$. The signal at point b is:

$$x(t) = [A+m(t)]^2 \cos^2\omega_c t$$

$$x^2(t) = \frac{A^2+m^2(t)+2Am(t)}{2}\,[1+\cos 2\omega_c t]$$

LPF suppresses higher frequency components i.e $\cos 2\omega_c t$ in this case hence the output at point c is

$$y = \frac{A^2+m^2(t)+2Am(t)}{2}$$

$$= \frac{A^2}{2}\left[1+\frac{2m(t)}{A}+\left(\frac{m(t)}{A}\right)^2\right]$$

As mostly $\frac{m(t)}{A} << 1$. Only when

$m(t)$ is near its peak, this condition is violated. Hence the output at point d is.

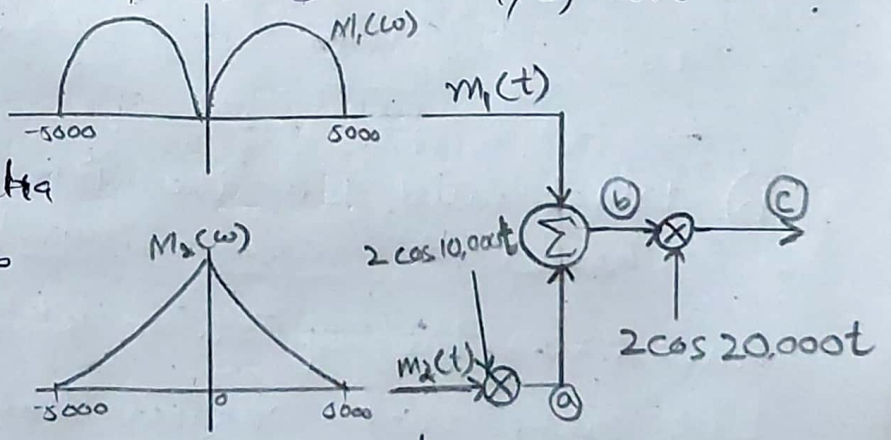
$$y \cong \frac{A^2}{2} + m(t)$$

Blocking capacitor will suppress dc term $A^2/2$.

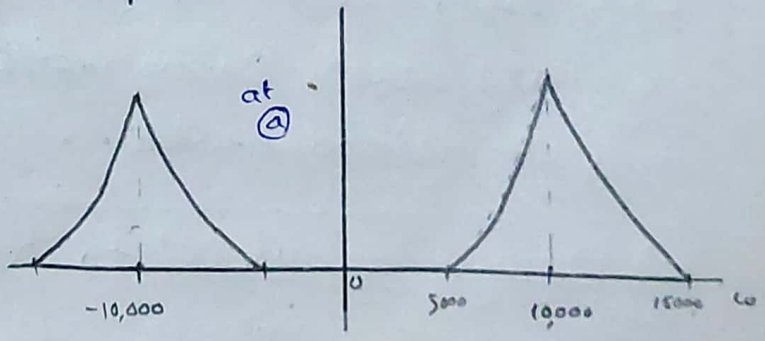
Question # 2:

Two signals $m_1(t)$ and $m_2(t)$, both bandlimited to 5000 rad/s, are ....

a) sketch signal spectra at point a, b and c.



Sol:

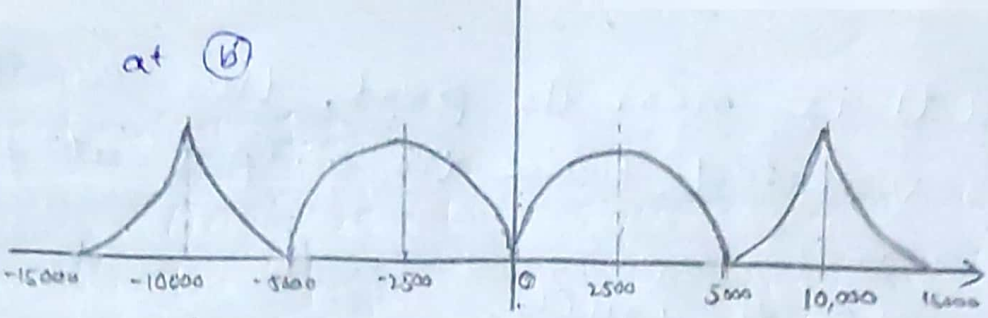


(a) at point a the signal $m_2(t)$ will be centered at $\pm 10K$ ω. as shown above.

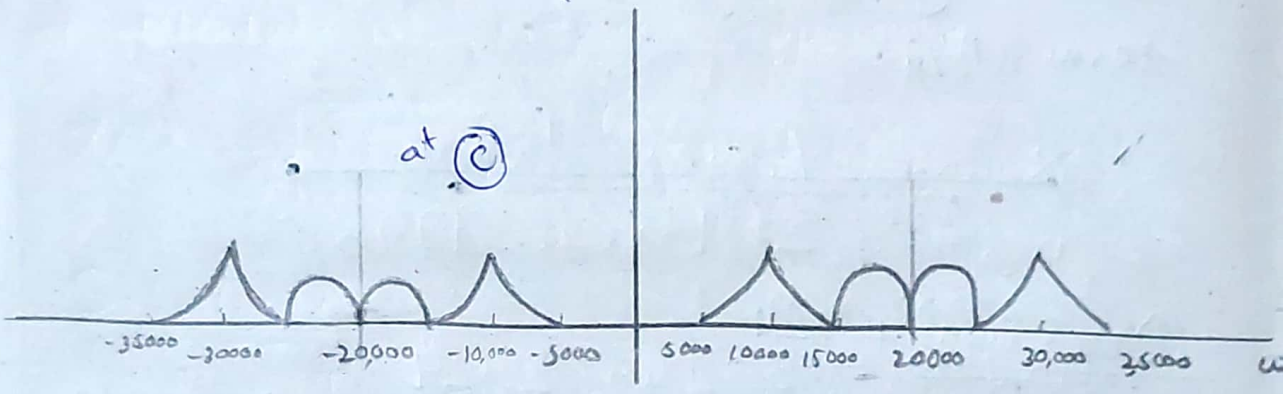
(b) at point be both signal will be added i.e $m_1(t)$ is added with $m_1(t) 2\cos 10000t$

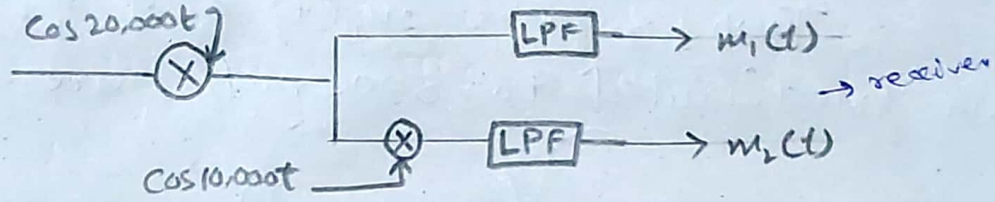
(3)

at (b)



(c) at point c the above signal will be shifted and centered at ± 20000,





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b) What must be the BW of the Channel.

Ans: From the spectrum at point c, it is clear that channel bandwidth must be at least 30,000 rad/s from 5000 to 35000 rad/s.

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c) Design a receiver to recover signal...

Ans. In above figure the receiver is shown that can be used to recover signal $m_1(t)$ and $m_2(t)$ from the received modulated signals.