VII. Quadrature Sampling of Bandpass signals:-

→ consider a bandpass signal centered around f_c. The highest frequency component in $G(f)$ is f_c+W. The sampling rate will be $2(f_c+W)$ according to nyquist rate. As f_c high the sampling rate is also high. This sampling rate can be reduced by quadrature sampling

"Quadrature sampling is sampling of a bandpass signal in terms of its inphase & quadrature phase components, each of which is sampled separately"

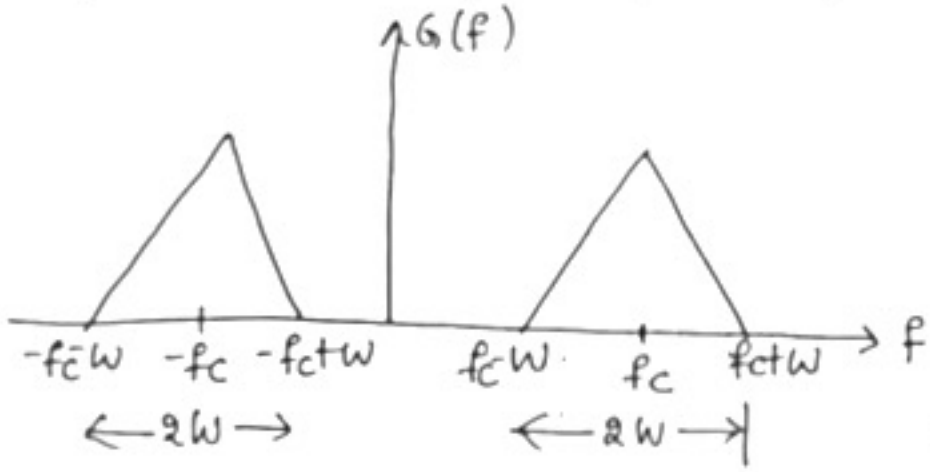

fig (1): Bandpass signal

Consider a bandpass signal $g(t)$ whose spectrum is limited to a bandwidth $2W$, centered around frequency f_c as shown in above fig (1).

Now $g(t)$ is expressed in terms of inphase $g_I(t)$ & quadrature phase $g_Q(t)$ is given by,

$$g(t) = g_I(t) \cos 2\pi f_c t - g_Q(t) \sin 2\pi f_c t \quad \text{———} (1)$$

where, Inphase $g_I(t)$ & quadrature phase $g_Q(t)$ is obtained by multiplying the $g(t)$ bandpass signal by $\cos 2\pi f_c t$ & $\sin 2\pi f_c t$ respectively. and then suppressing the sum of frequency components by means of low pass filters. as shown in fig (2) cos $2\pi f_c t$ & sin $2\pi f_c t$ respectively. and then suppressing the sum of frequency components by means of low pass filters. as shown in fig (2)

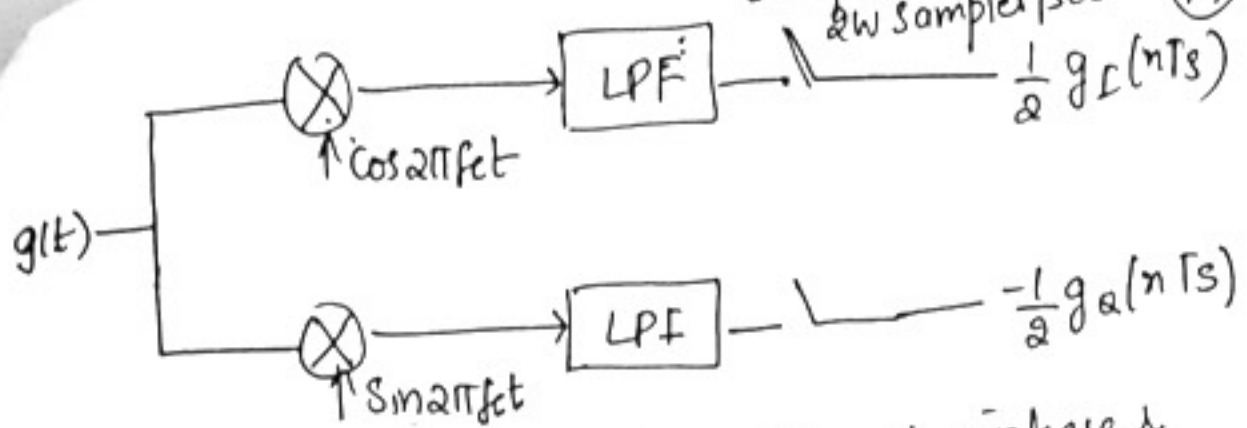

fig (2) Generation of inphase & quadrature samples from bandpass signal g(t)

Each component is sampled at a rate of 2W samples/sec. This form of sampling is known as quadrature sampling.

Reconstruction

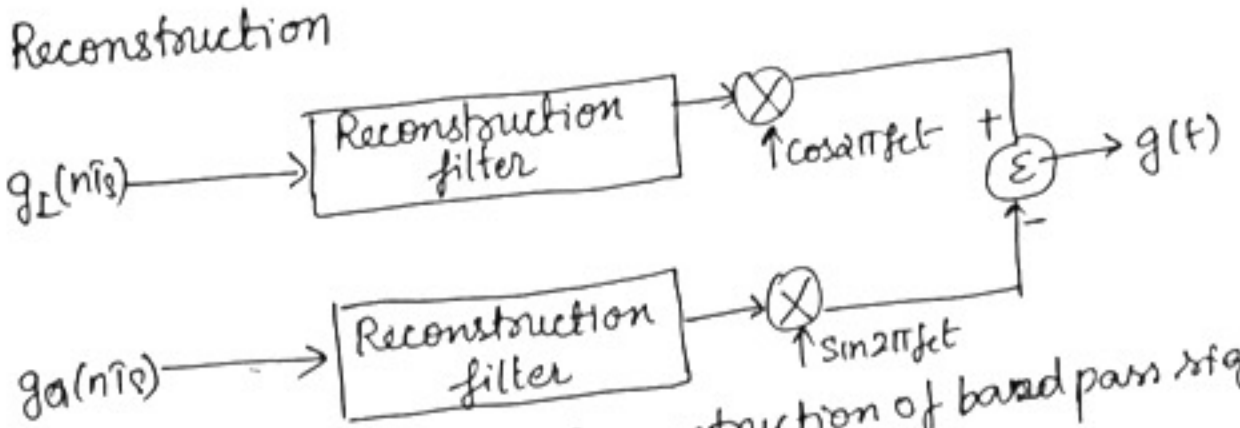

fig (3): Reconstruction of bandpass signal g(t) from its

To reconstruct the original bandpass signal from its quadrature sampled version, we need to first reconstruct inphase $g_I(t)$ & quadrature component $g_Q(t)$ from their respective samples,
Then multiply them by cos $2\pi f_c t$ & sin $2\pi f_c t$ and Add the results to obtain g(t).

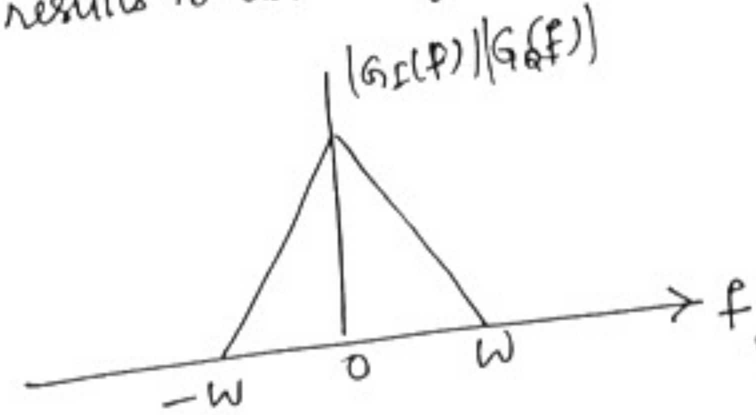

fig (4): spectrum of lowpass inphase & quadrature component.