a function of frequency is the required characteristic.

Characteristics of Matched Filter Receiver

The impulse response of the matched filter resembles the mirror image of the received waveform. The impulse response of a matched filter is the inverse Fourier transform of the frequency response function. It is given by,

$$h(t) = \int_{-\infty}^{\infty} H(f) \exp(j2\pi ft)\, df \qquad \ldots (1)$$

It is also defined as the output of the filter as a function of time, when the input is an impulse i.e.,

$$h(t) = G_a \int_{-\infty}^{\infty} S^*(f) \exp(-j2\pi f(t_1 - t))\, df \qquad \ldots (2)$$

Where,

$S^*(f)$ – Complex conjugate of $S(f)$

t_1 – Fixed value of time at which a signal is observed to be maximum

G_a – A constant, equal to maximum filter gain.

But,

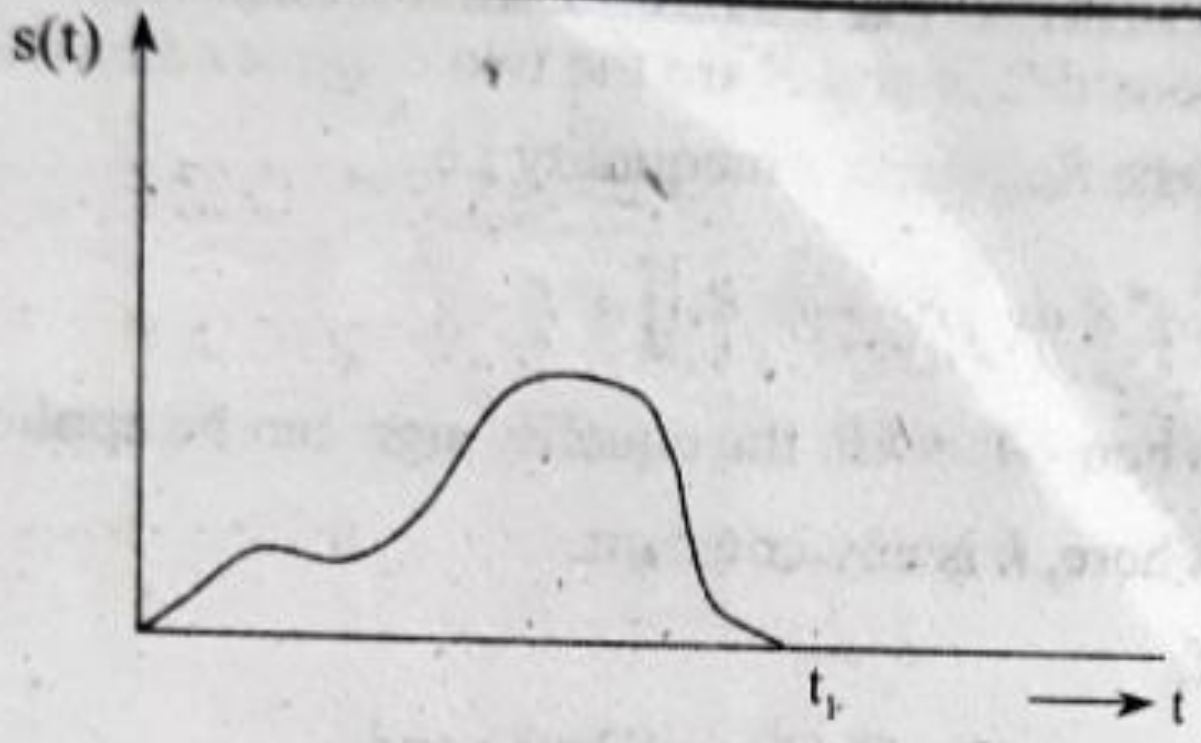
$$S^*(f) = S(-f)$$

So, equation (2) can be written as,

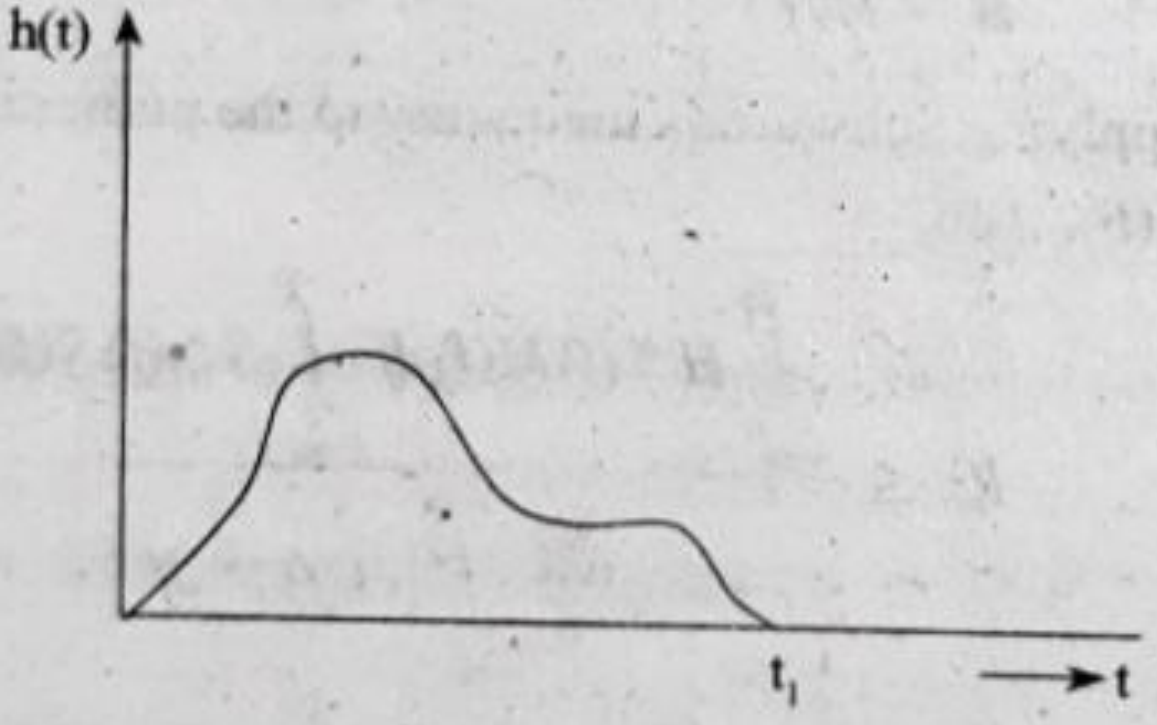
$$h(t) = G_a \int_{-\infty}^{\infty} S(f) \exp\left[j2\pi f(t_1 - t)\right] df$$

$$h(t) = G_a\, s(t_1 - t)$$

The impulse response of a matched filter is not defined for $t < 0$. Figure below illustrates the impulse response for a signal $s(t)$.



(a) Received Waveform s(t)



(b) Impulse Response h(t)

Figure