Flat top Sampling :-

The pulses observed in case of natural sampling are not frequently employed. Instead of this, flat top pulses can be used easily because these pulses have a constant amplitude within complete pulse interval. In this type of sampling the original signal can not be recovered exactly however the distortion is not too large. This type of sampling has the advantage that it can easily employed to electric circuits. Thus, it simplify the designing of electronic circuit.

Thus, it . To generate the flat top pulses, we pass the instantaneously sampled impulse of width dt through a network which brought a impulse of width τ. Thus, we get a pulse of same amplitude but of duration τ. As shown in fig (6) Now, we know the transform of a pulse of unit amplitude and width dt is given as

$$F(\text{Impulse of width } dt) = dt$$

But the transform of pulse of unit amplitude and width τ is given as

$$F\left(\text{pulse amp} = 1, \text{ extending from } t = -\frac{\tau}{2} \text{ to } +\frac{\tau}{2}\right)$$

$$= \tau \frac{\sin(\omega\tau/2)}{\omega\tau/2}$$

Hence, the transfer function of a network in fig (b) must be

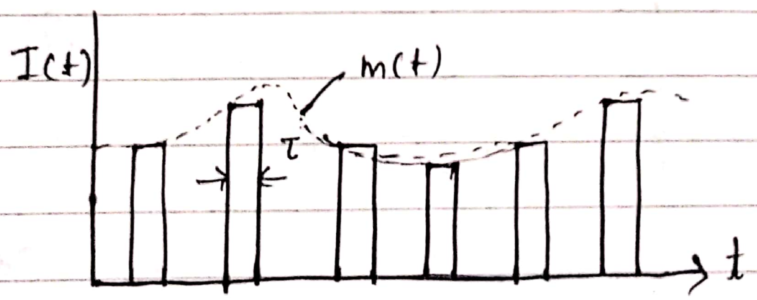
$$M(j\omega) = \frac{\tau}{T_s} \frac{\sin(\omega\tau/2)}{\omega\tau/2}$$

Now, let us consider a signal m(t) with transform M(jω), which is band limited to freq f_m and sampled with minimum allowed freq. Then in the range 0 to f_m, the transform of a flat top sampled signal is given as

$$F(\text{flat top sampled } m(t)) = \frac{\tau}{T_s} \cdot \frac{\sin(\omega\tau/2)\, M(j\omega)}{\omega\tau/2}$$

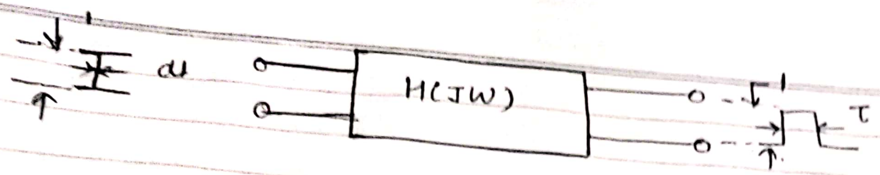
$$0 \le f \le f_m.$$

Now, to understand the effect of flat top sampling we consider the signal m(t) having flat spectral density M_0 over the range 0 to f_m. As shown in fig (c). The form of the transform of the signal with instantaneously sampled is shown fig (d). while the spectrum of flat top sampled signal is shown in fig (F).



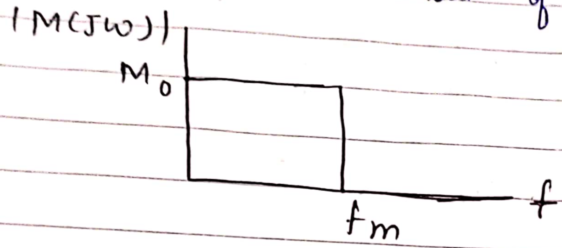
(a)

a) Flat Top Sampling



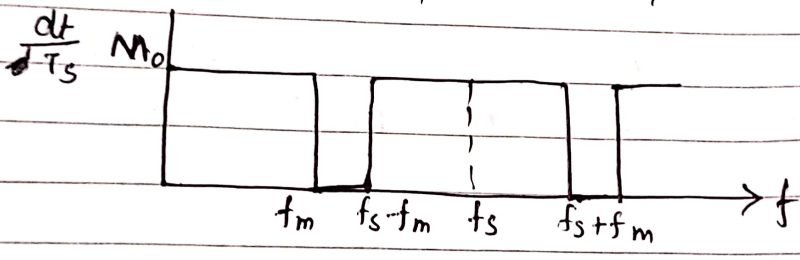
(b)

A Network with transform H(JW) which converts a pulse of width dt into a rectangular pulse eq like amplitude but of duration τ



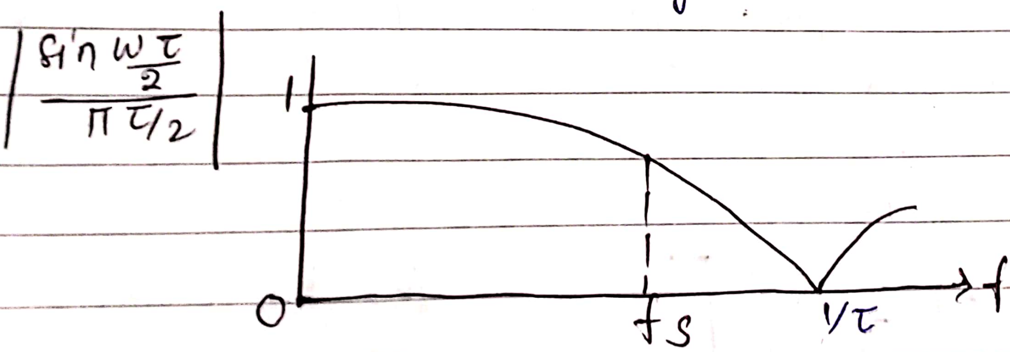
(c) → original signal

c) An idealized spectrum of a base band signal



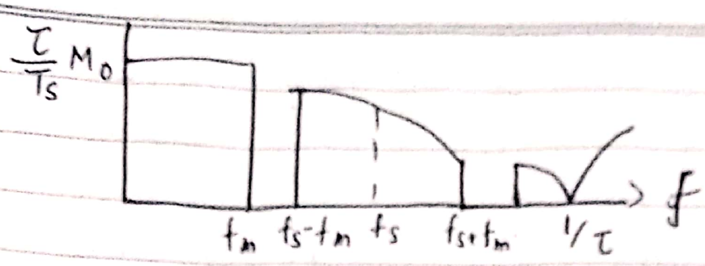
(d)

Instantaneously sampled signal.



(e)

Fig (e) The form $\left[\frac{\sin x}{x}, \text{ with } x = W\tau/2 \right]$ of the distortion factor (aperture effect) introduced by flat topped sampling



(f)

fig (f) The Spectrum of the signal with flat-topped Sampling from fig. It is clear that there is a distortion in the sampled signal which results from the fact that the spectrum is multiplied by the factor $\frac{\sin \omega\tau/2}{\omega\tau/2}$ which falls

slowly in the neighbourhood of $x = 0$ and falls to zero at $x = \pi$. Thus to minimise the distortion it is required that we arrange $x = \pi$ corresponds the freq. very large in comparision to fm. Thus, we have $x = \pi$ when $\tau = \frac{1}{f}$ with $f >> f_m$ or $\tau < \frac{1}{f_m}$

But for the shape of large amplitude of output signal it is necessary that τ must be large, but it create distortion which is not ~~accelerated~~ acceptable. To remove this problem we include equaliser in series with the o/p of low pass filter. The equaliser is a passive network with transfer function of the form $x/\sin x$ i.e. inverse from the transfer function of $H(\omega)$. Thus equalizer in combination with distortion factor gives a flat transfer characteristic at the receiving end of the system.