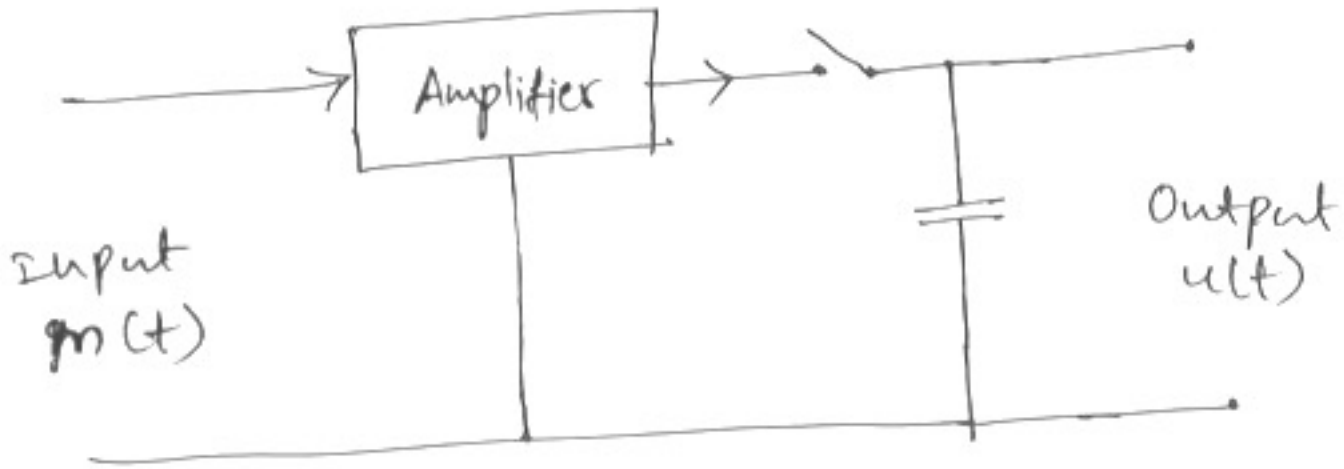
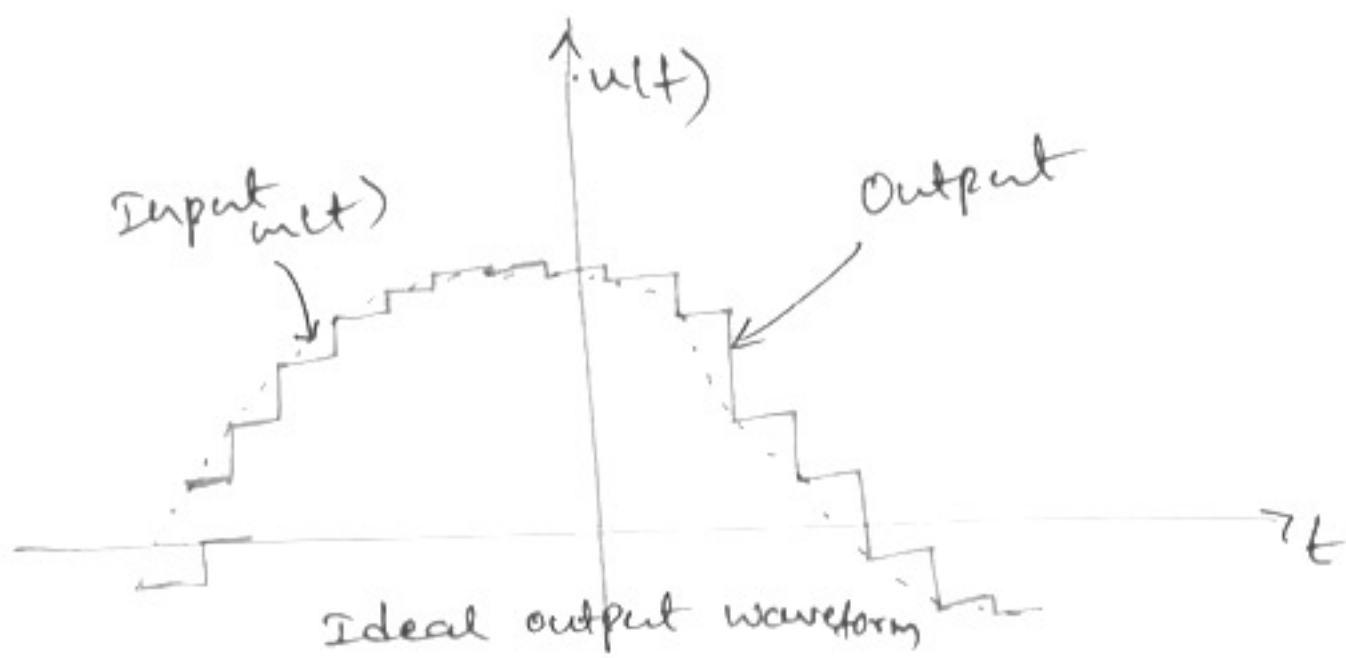
SAMPLE and HOLD Circuit

In natural sampling and flat-top sampling the spectr of sampled signal is scaled by the sampli ratio T/T_s, whes T is the sampling pulse duration and T_s is the sampling Period. Typically this ratio is quite small resulting the signal power at the output of low-pass reconstruction filter to be correspondingly small.

We may remedy this situation by the use of ~~compensatio~~ ~~ion~~ a sample-and-hold circuit as shown in fig belo



sample-and-hold circuit



Ideal output waveform

Working:

The circuit consists of an amplifier of unity gain and low Output impedance, a switch, and a capacitor. It is assumed that the load impedance is large. The switch is timed to close only for the small duration T of each sampling pulse, ~~which~~ ~~but~~ during which time capacitor rapidly charges up to a voltage level equal to that of the input sample. which the switch is open, the capacitor retains its voltage level until the next closure of the switch. Thus sample and hold circuit, in its ideal form, produces an output waveform shown in previous fig. that represents a staircase interpolation of the original signal.

From the concept of Flat-top sampling, we can deduce the output of sample-and-hold circuit as

$$u(t) = \sum_{n=-\infty}^{\infty} m(nT_s)\, h(t - nT_s)$$

where ~~h(t)~~

$$h(t) = \begin{cases} 1 & 0 < t < T_s \\ 0 & t < 0, \text{ and } t > T_s \end{cases}$$

Further, the spectrum of sample and hold circuit can be written as

$$U(F) = F_s \sum_{K=-\infty}^{\infty} M(F-KF_s)\, H(F)$$

where

$$H(F) = T_s \operatorname{sinc}(FT_s)\, e^{-j\pi FT_s}$$

RECONSTRUCTION In sample and HOld Sampling

The output of sample and HOld circuit i.e u(t) is passed through a low-pass filter designed to remove components of the spectrum U(F) at multiples of F_s and an equalizer whose amplitude response equals $\frac{1}{|H(F)|}$.