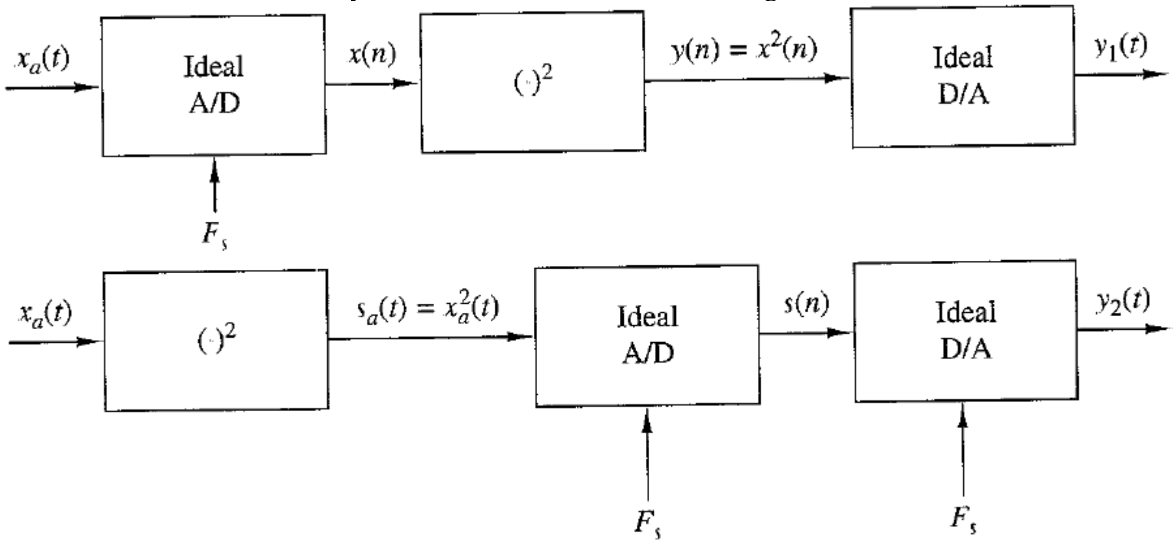
Task 2

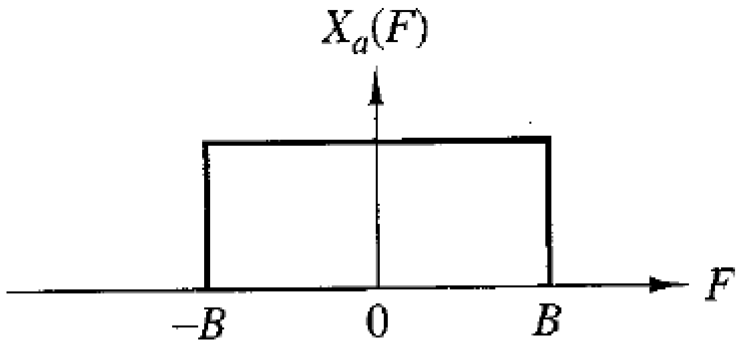
1. Sampling and reconstruction of sinusoidal signals.
2. DTFT, DFT analysis of sampled and reconstructed signals.
3. A/D – Sampler (Time / down sampling/Scaling – Discretization of time (x)-axis) + Quantiser (Discretization of Amplitude (y)-axis – Round-off / Truncate the amplitude values to the nearest integers)+ Encoder (binary / Digital)
4. D/A- Decoder (binary / Digital) + Inverse quantization + Up sampler / Interpolator

1. Consider the two systems shown in the below fig.



a. Sketch the spectra of the various signals if $x_a(t)$ has the Fourier transform shown in the below fig. and $F_s = 2B$. How are $y_1(t)$ and $y_2(t)$ related to $x_a(t)$?

b. Determine $y_1(t)$ and $y_2(t)$ if $x_a(t) = \cos 2\pi F_0 t, F_0 = 20\text{Hz}$, and $F_s = 50Hz$ and $F_s = 30\text{Hz}$.



2. Frequency analysis of amplitude-modulated discrete-time signal-The discrete-time $x(n) = \cos 2\pi f_1 n + \cos 2\pi f_2 n, f_1 = \frac{1}{18}, f_2 = \frac{5}{128}$, modulates the amplitude of the carrier $x_c(n) = \cos 2\pi f_c n$ with $f_c = \frac{50}{128}$. The resulting amplitude-modulated signal is
$x_{\text{am}}(n) = x(n)x_c(n) = x(n)\cos 2\pi f_c n$

- Sketch the signals $x(n), x_c(n)$, and $x_{am}(n)$, $0 \le n \le 255$.
- Compute and sketch the 128-point DFT of the signal $x_{am}(n)$, $0 \le n \le 127$. N=128
- Compute and sketch the 128-point DFT of the signal $x_{am}(n)$, $0 \le n \le 99$.
- Compute and sketch the 256-point DFT of the signal $x_{am}(n)$, $0 \le n \le 179$.
- Explain the results obtained in parts (b) through (d), by deriving the spectrum of the amplitude-modulated signal and comparing it with the experimental results.

- Max. magnitude (assumption) = 8 ($x_a(t)$) – 64 - 000000 – 100000 – Encoding
- 0 – 000 000, 1 – 000 001, ….64 – 100000. Aa = zeros(1,i);
- Decoding
- $X(k) = \sum_{n=0}^{N-1} x(n)e^{-j\frac{2\pi kn}{N}}$ k,n.

3. Determine the signal $x(n)$ if its Fourier transform is as given in the below figure.