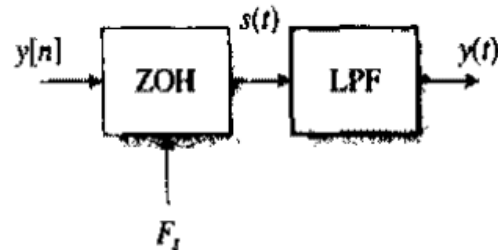
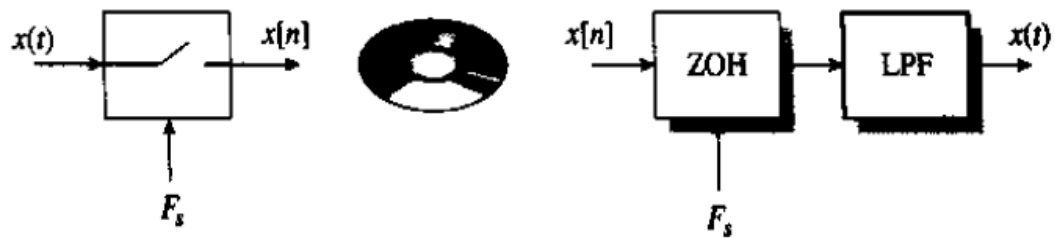


- 2.4** In the system shown, let the sequence be $y[n] = 2 \cos(0.3\pi n + \pi/4)$ and the sampling frequency be $F_s = 4\text{kHz}$. Also let the lowpass filter be ideal, with bandwidth $F_s/2$.

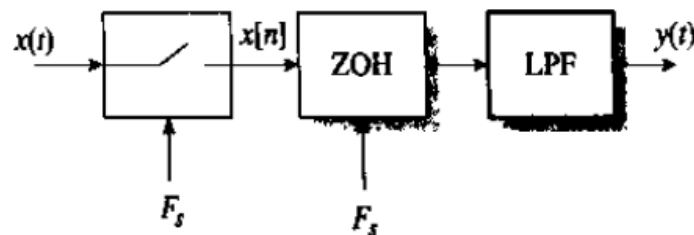


- Determine an expression for $S(F) = \text{FT}\{s(t)\}$. Also sketch the frequency spectrum (magnitude only) within the frequency range $-F_s < F < F_s$.
 - Determine the output signal $y(t)$.
- 2.5** We want to digitize and store a signal on a CD, and then reconstruct it at a later time. Let the signal $x(t)$ be $x(t) = 2 \cos(500\pi t) - 3 \sin(1000\pi t) + \cos(1500\pi t)$ and let the sampling frequency be $F_s = 2000\text{ Hz}$.
- Determine the continuous time signal $y(t)$ after the reconstruction.
 - Notice that $y(t)$ is not exactly equal $x(t)$. How could you reconstruct the signal $x(t)$ exactly from its samples $x[n]$?

CHAPTER 2 Discrete Time Processing of Continuous Time Signals



2.6 In the system shown, determine the output signal $y(t)$ for each of the following input signals $x(t)$. Assume the sampling frequency $F_s = 5$ kHz and the lowpass filter (LPF) to be ideal, with bandwidth $F_s/2$.

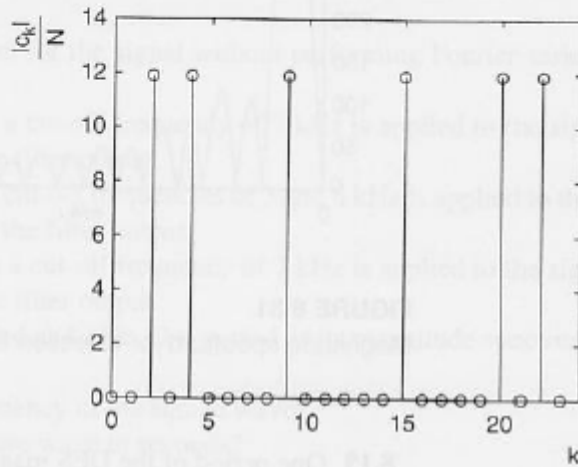


- a. $x(t) = e^{j2000\pi t}$
- ☒ b. $x(t) = \cos(2000\pi t + 0.15\pi)$
- c. $x(t) = 2 \cos(5000\pi t)$
- ☒ d. $x(t) = 2 \sin(5000\pi t)$
- ☒ e. $x(t) = \cos(2000\pi t + 0.1\pi) - \cos(5500\pi t)$

- waves:
- 8.15** A periodic digital signal is obtained by sampling an analog signal at 12 kHz. One period of its magnitude spectrum is shown in Figure 8.30.
- What is the period of the digital signal, measured in number of samples?
 - What frequencies in Hz were present in the analog signal?
 - What are the digital frequencies of the components of the digital signal?

FIGURE 8.30

Magnitude spectrum for
Question 8.15.



8.22 A periodic square wave is sampled at 4 kHz. One period of its magnitude spectrum is shown in Figure 8.33.

- What is the fundamental frequency of the square wave?
- What is the period of the square wave in seconds?
- What is the average value of the square wave?
- If the square wave is filtered by a high order low pass filter with a cut-off frequency of 500 Hz, what frequencies will be present in the filtered output?

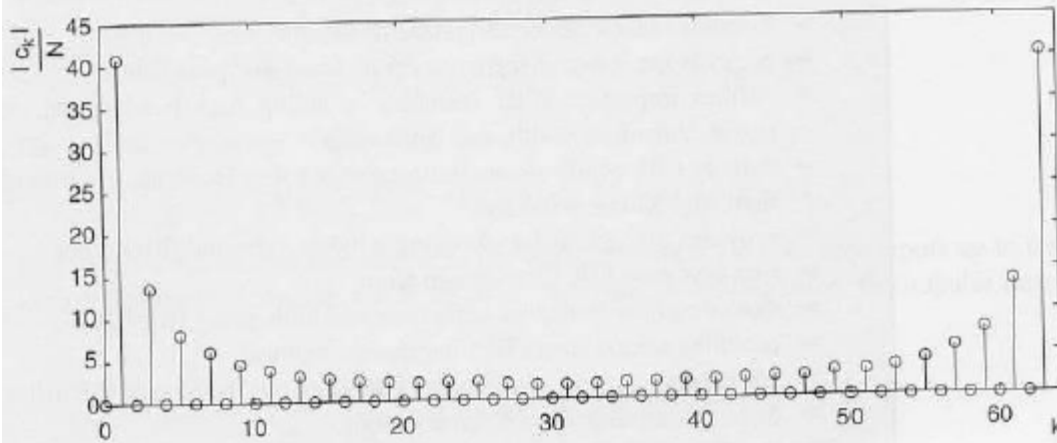


FIGURE 8.33

Magnitude spectrum for Question 8.22.