



National Institute of Technology Andhra Pradesh
Department of Electronics and Communication Engineering
EC 203: Signals and Systems
Assignment 3

1. Consider the feedback system of Figure 1. Assume that $y[n] = 0$ for $n < 0$.

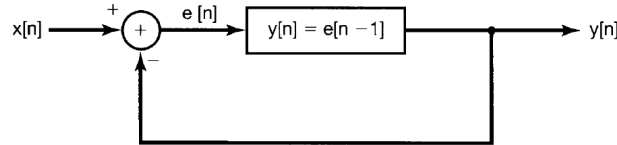


Figure 1

- (a) Sketch the output when $x[n] = \delta[n]$.
 - (b) Sketch the output when $x[n] = u[n]$.
2. A linear system S has the relationship

$$y[n] = \sum_{k=-\infty}^{\infty} x[k]g[n - 2k]$$

between its input $x[n]$ and its output $y[n]$, where $g[n] = u[n] - u[n - 4]$.

- (a) Determine $y[n]$ when $x[n] = \delta[n - 1]$.
 - (b) Determine $y[n]$ when $x[n] = \delta[n - 2]$.
 - (c) Is S LTI?
 - (d) Determine $y[n]$ when $x[n] = u[n]$.
3. (a) Consider an LTI system with input and output related through the equation

$$y(t) = \int_{-\infty}^t e^{-(t-\tau)} x(\tau - 2) d\tau$$

What is the impulse response $h(t)$ for this system?

- (b) Determine the response of the system when the input $x(t)$ is as shown in Figure 2
4. The following are the impulse responses of discrete-time LTI systems. Determine whether each system is causal and/or stable. Justify your answers.
- (a) $h[n] = (\frac{1}{2})^n u[-n]$
 - (b) $h[n] = (5)^n u[3 - n]$
 - (c) $h[n] = (-\frac{1}{2})^n u[n] + (1.01)^n u[1 - n]$

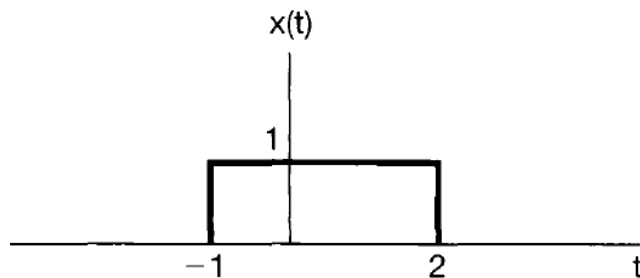


Figure 2

- (d) $h[n] = n(\frac{1}{3})^n u[n - 1]$
5. The following are the impulse responses of continuous-time LTI systems. Determine whether each system is causal and/or stable. Justify your answers.
- (a) $h(t) = e^{2t}u(-1 - t)$
- (b) $h(t) = e^{-6|t|}$
- (c) $h(t) = te^{-t}u(t)$
- (d) $h(t) = (2e^{-t} - e^{\frac{(t-100)}{100}})u(t)$
6. For each of the following pairs of waveforms, use the convolution integral to find the response $y(t)$ of the LTI system with impulse response $h(t)$ to the input $x(t)$. Sketch your results.
- (a) $x(t) = e^{-\alpha t}u(t)$, $h(t) = e^{-\beta t}u(t)$. Do this when $\alpha \neq \beta$ and $\alpha = \beta$
- (b) $x(t) = u(t) - 2u(t - 2) + u(t - 5)$, $h(t) = e^{2t}u(1 - t)$
- (c) $x(t)$ and $h(t)$ are as in Figure 3(a).
- (d) $x(t)$ and $h(t)$ are as in Figure 3(b).
- (e) $x(t)$ and $h(t)$ are as in Figure 3(c).

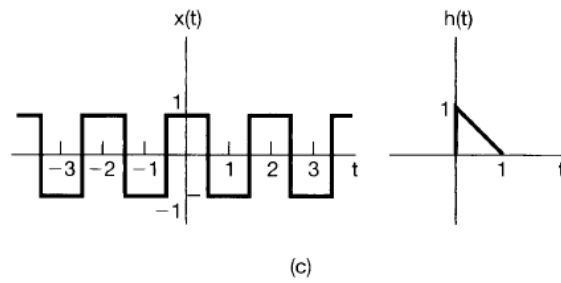
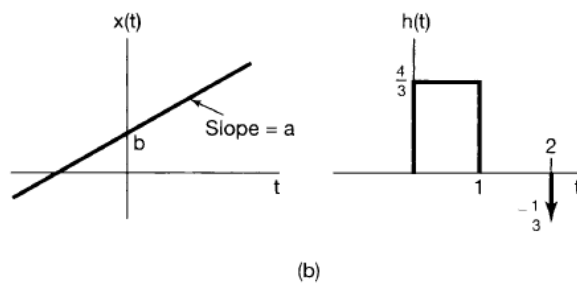
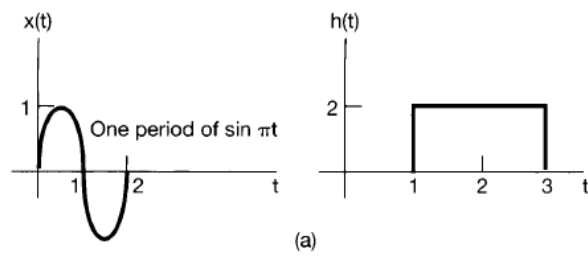


Figure 3