

Indian Institute of Space Science and Technology
Signals and Systems (AV223)
Department of Avionics

Quiz 1

16th February 2023, Marks: 15, Time: 9.00 am to 10 am

Answer ALL questions

1. Sketch the following for the given signal $x(t)$ in Figure 1. [2 Marks]

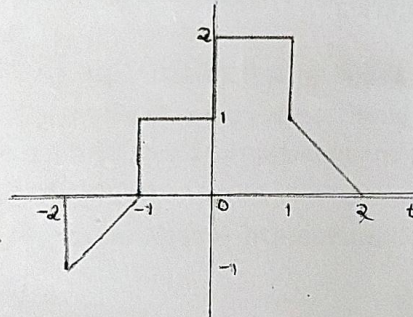


Figure 1:

- (a) $x(2t + 1)$
(b) $x(4 - t/2)$
2. Using convolution determine and sketch the output response of a linear time invariant system with impulse response $h[n] = 2\delta[n+1] + 2\delta[n-1]$ for the input given by $x[n] = 2\delta[n] + 2\delta[n-1] - \delta[n-3]$. [2 Marks]
3. Using classical method solve $(D^2 + 4D + 4)y(t) = (D+1)x(t)$ for initial conditions $y(0^+) = 9/4$, $\dot{y}(0^+) = 5$ and input $x(t) = u(t)$. [2 Marks].
4. The impulse response of a discrete time LTI system is given by $h[n] = n(\frac{1}{3})^n u[n-1]$. Is this system causal? Is this system stable. (specify reasons) [1 Mark]
5. A continuous time signal with input $x(t)$ and output $y(t)$ are related by $y(t) = t^2 x(t-1)$. Comment about the linearity and time invariance. [1 Mark]
6. Determine if the following systems are invertible if it is write the inverse. [1.5 Marks]

- (a) $y(t) = x(t - 4)$
 (b) $y(t) = \int_{-\infty}^t x(\zeta) d\zeta$
7. State whether the given signal $x[n] = 2\cos(\frac{\pi}{4}n) + \sin(\frac{\pi}{8}n) - 2\cos(\frac{\pi}{2}n + \frac{\pi}{6})$ is periodic. Find the period if it is periodic. [1 Mark]
8. Which of the following signals are energy/power signal? Also calculate the energy/power. [1.5 Marks]
- (a) $x(t) = e^{-3t}u(t)$
 (b) $x(t) = e^{j(2t + \frac{\pi}{4})}u(t)$
9. Find the zero input response of a system described by the equation $y[n] + 0.3y[n-1] - 0.1y[n-2] = x[n] + 2x[n-1]$. The initial conditions are $y_0[-1] = 1$ and $y_0[-2] = 33$. [1.5 Marks]
10. For the continuous time periodic $x(t) = 2 + \cos(\frac{2\pi}{3}t) + 4\sin(\frac{5\pi}{3}t)$, determine the fundamental frequency ω_0 and Fourier series coefficients such that $x(t) = \sum_{k=-\infty}^{\infty} a_k e^{jk\omega_0 t}$. [1.5 Marks]