

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

Quiz 2

30th March 2023, Marks: 15, Time: 9.00 am to 10 am

Answer ALL questions (show clear steps)

1. Consider a system with impulse response $h(n) = [(1/2)^n \cos(\frac{n\pi}{2})]u(n)$. [2 Marks]
 - (a) Determine the system transfer function $H(\Omega)$.
 - (b) Find the output $y(n)$ if an input $x(n) = \cos(\frac{n\pi}{2})$ is given as input to $H(\Omega)$.
2. The pole zero plot of an LTI system $H(s)$ is given by [1.5 Marks]

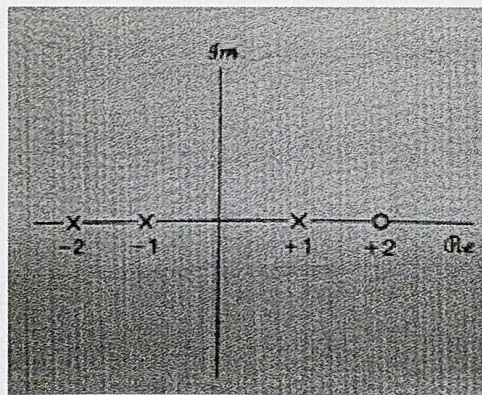


Figure 1:

- (a) Indicate all possible ROCs that can be associated with the pole-zero pattern.
 - (b) For all ROCs indicate the system is stable and /or causal.
3. Find the output response of the second order difference equation given by $y''(t) + 5y'(t) + 6y(t) = x(t)$, with initial conditions $y(0) = 2, y'(0) = 1$ and has input $x(t) = e^{-t}u(t)$. [2 Marks]
4. Consider a DT system unit sample response $h(n) = (\frac{1}{2})^n u(n) + \frac{1}{2} (\frac{1}{4})^n u(n)$. Determine the linear constant coefficient difference equation relating the input and output of the system using Fourier transform. [1 Mark]

5. Determine the Laplace transform, associated ROC, and pole zero plot of the given signal $x(t) = e^{-4t}u(t) + e^{-5t}(\sin 5t)u(t)$. [1.5 Marks]
6. The Z transform of a sequence $x[n]$ is $X(z) = \frac{0.5}{1-2z^{-1}}$. The ROC includes unit circle. Find the value of $x(0)$. [1 Mark]
7. Find the Laplace transform $x(t) = 3e^{-3(t-2)}u(t-2)$. [1 Mark]
8. Consider a signal $y(t)$ which is related to two signals by $y(t) = x_1(t-2)*x_2(-t+3)$ where $x_1 = e^{-2t}u(t)$ and $x_2 = e^{-3t}u(t)$. Determine the output response $Y(s)$ and $y(t)$. [2 Marks]
9. The Z transform of a system is given by $c(z) = \frac{z^{-1}(1-z^{-4})}{4(1-z^{-1})^2}$, find the final value. [1.5 Marks]
10. Consider the signals given below. Find the Z transform and associated ROCs. [1.5 Marks]
 - (a) $x(n) = \left(\frac{1}{5}\right)^n u(n-3)$
 - (b) $x(n) = a^{n+1}u(n+1)$