

**The LNM Institute of Information Technology, Jaipur**  
**EC326: Digital Signal Processing**  
**Mid Term Exam 2022-23, Odd semester**

**Max Marks: 30****Date: Oct. 01, 2022****Time: 90 Mins**

Total Questions	Total Marks	CO1	CO2	CO3	CO4	CO5	CO6
6	30	Q1, Q4, Q6	Q2, Q5, Q4	Q3	---	--	--
<b>CO weightage</b>		12/30 = 40%	14/30 = 46%	4/30 = 14%			

Instructions:

- This Question paper is printed on both sides and have 6 questions. All the questions are mandatory.
- Write all the sub-parts of a question at one place.
- All the notations have their usual meanings.

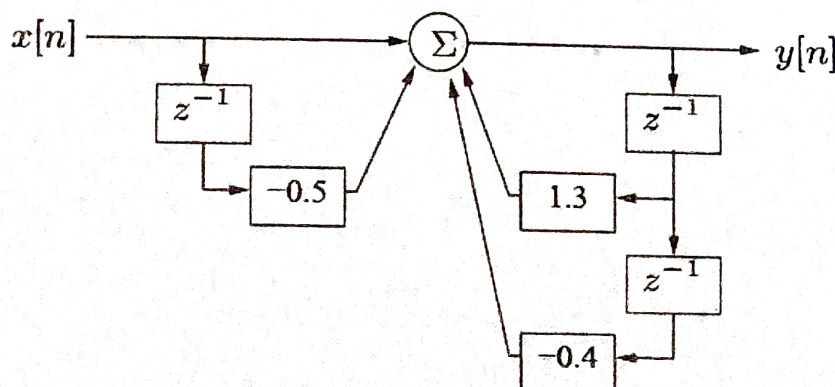
- 1) A continuous-time signal  $x(t) = 3 \cos(2\pi \times 300t)$  is transmitted over a digital communication link that carries binary-coded words representing samples of an input signal. The link is operated at 10 kbits/s and each input sample is quantized into 1024 different levels.

- Determine the sampling frequency  $f_s$ . [1]
- Determine the Nyquist rate for the signal  $x(t)$ . [1]
- Write the expression of the discrete-time signal  $x[n]$  for the sampling frequency obtained in part (a). [2]
- Find the value of resolution  $\Delta$ ? [1]
- Find the  $\text{SNR}_q$  in dB. [1]

- 2) For the following causal system

$$y[n] = \frac{3}{4}y[n-1] - \frac{1}{8}y[n-2] + x[n]$$

- Determine the impulse response. [1]
- Determine the step response. [1]
- Plot the pole-zero pattern. [1]
- Is the system stable or not? [1]
- Find the system function  $H(z)$  for the discrete-time system shown in the figure below [3]



- 3) Given a discrete-time signal  $x[n] = 1 + \cos\left(\frac{2\pi}{6}n\right)$ .
- Find the fundamental period of the discrete-time signal. [1]
  - Determine the discrete-time Fourier series coefficients of the discrete-time signal  $x[n]$ . [2]
  - Calculate the power of the signal. [1]
- 4)
- Given a discrete-time signal  $x[n] = \left(\frac{1}{2}\right)^n u[n] + 3^n u[-n-1]$ . Find  $R_{xx}(z)$  and determine the autocorrelation function  $r_{xx}[l]$ . [3]
  - Find and plot the autocorrelation of the signal  $x(n) = \alpha^n u(n)$ ,  $|\alpha| < 1$ , with out using z-transform. [3]
- 5) Determine the output of the discrete-time system expressed by the following difference equation

$$y[n] = 0.7y[n-1] - 0.12y[n-2] + x[n-1] + x[n-2]$$

to the input  $x[n] = nu[n]$ . (Hint: Use Z- transform Property) [4]

- 6) For the following discrete-time systems verify the preparties given as 1, 2, 3. [3]

a)  $y[n] = \sum_{k=-\infty}^{n+1} x[k]$

b)  $y[n] = x[n] + nx[n+1]$

Properties

- Linear or nonlinear
- Causal or noncausal
- Stable or unstable

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