Noakhali Science and Technology University

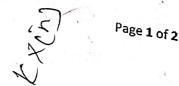
Department of Computer Science and Telecommunication Engineering

3rd Year 1st Term B.Sc. (Engg.) Final Examination-2024

Course Code: CSTE 3103

Course Title: Digital Signal Processing

Time: 4 hours. Total Marks: 70 [Answer any seven of the following questions. Figures in the right-hand margin indicate full marks] Write down the steps for analog to digital conversion and explain briefly. a) 5 Consider the analog signal $x_a(t) = 6 \cos 50\pi t$ b) 3 Determine the minimum sampling rate required to avoid aliasing. Suppose that the signal is sampled at the rate $F_s = 100 \, Hz$. What is the ii. discrete-time signal obtained after sampling? Evaluate the convolution of following two signals: c) 2 $x1(n) = \{-2, 2, -2, 3\}$ $x2(n) = \begin{cases} 2, & 0 \le n \le 4 \\ 0, & elsewhere \end{cases}$ Define unit sample signal, unit step signal, unit ramp signal, and exponential signal. Compute the convolution y(n) of the signals i. Graphically ii. Analytically Find the inverse transform of X(z) using partial fraction method $X(Z) = \frac{1}{3Z^2 - 4Z + 1}$ 5 Determine the z-transform and the ROC of the signal $x(n) = [3(2^n) - 4(3^n)]u(n)$ 5 Determine the autocorrelation sequences of the following signals 5 (i) $x(n) = \{1,2,1,1\}$ \uparrow (ii) $y(n) = \{1,1,2,1\}$ What do you mean by Recursive and Nonrecursive discrete time systems? Explain b) 5 briefly. Determine the zero-input response of the system described by the homogeneous second-order difference equation y(n) - 3y(n-1) - 4y(n-2) = 05 Determine the total solution y(n) in ≥ 0 to the difference equation $y(n) + a_1 y(n-1) = x(n)$ 5 Where x(n) is a unit step sequence and y(-1) is the initial condition. State Nyquist sampling theorem. Find the Nyquist rate for the following signal $Xa(t) = 5Cos100\pi t + 10Sin300\pi t + Sin150\pi t.$ Derive the relationship between Analog frequency and digital frequency with 3 sampling frequency for the sampling of Analog periodic signal. Describe Sample and Hold method in D/A conversion of signal with proper figure. Distinguish between Fourier series and Fourier transform. 3



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b) Define DTFT and IDTFT with equations. Determine the frequency response $H(e^{i\omega})$ of 5 a system characterized by $h(n)=(0.6)^n \mu(n)$. Write half period, one period, and two period conditions to determine the output c) 3 response of DTFT system model. Write the advantages of Z-transform system over DTFT system. Explain the ROC of 6 Z-transform system. Compare between poles and zeros in Z-transform. If $H(Z) = \frac{Z+1}{Z^2 - 0.9Z + 0.81}$, Find: a) its transfer function representation, b) its 4 b) difference equation representation. 2 Draw the figures of symmetric and anti-symmetric impulse response h(n) of length M, where M is 11. Write the frequency response and difference equation of a FIR filter. Implement the b) structure of Cascade form FIR filter model, where length of filter is 9. Design a Direct form FIR filter model using appropriate difference equation of length c)

7 and describe briefly.