Question Paper

Exam Date & Time: 25-May-2023 (02:30 PM - 05:30 PM)

MANIPAL ACADEMY OF HIGHER EDUCATION

SIXTH SEMESTER B.TECH. (ELECTRONICS & INSTRUMENTATION ENGG.)
END SEMESTER DEGREE EXAMINATIONS, MAY - 2023

DIGITAL SIGNAL PROCESSING [ICE 3251]

Marks: 50 **Duration: 180 mins.**

A

Answer all the questions.

Instructions to Candidates: Answer ALL questions Missing data may be suitably assumed

1) Identify the application of linear convolution with an example. [CO1 , BL3, PO3] (2)

A)

B) Determine the inverse Z-transform for the following sequence (4)

$$Y(z) = \frac{3(1-z^{-1})}{(1-0.5z^{-1})(1-2z^{-1})}$$; y[n] is (i) causal and (ii)stable. [CO1 , BL3, PO3]

C) If the Z-transform X(z) has zeros at 0.5 and poles at 0.75, -0.5±j0.25, determine the poles and zeros of y[n]=x[-n+2]. [CO1, BL5, PO4] (4)

2) State and prove the circular frequency shift property of discrete Fourier transform. [CO2, BL3, PO2] (2)

A)

B) Consider a circle of any radius and plot its magnitude spectrum of center to border vectors. Interpret the significance of obtained spectrum in real time application. [CO2, BL5, PO4] (3)

C) For a given input sequence x(n) = {-1, 2, 2, 2, -1}, determine X(k) using radix 2 DIT FFT. [CO2, BL3, PO4] (5)

3) Apply bilinear transformation to $H(s) = \frac{4s}{s^2+0.4s+2}$ with T=2 sec and find H(z). [CO3, BL3, PO2] (2)

A)

B) Determine the order and poles of a type I Chebyshev filter that has a maximum passband attenuation of 2.5 dB at 15 rad/sec and stop band attenuation of 30 dB at 45 rad/sec. [CO3, BL3, PO3] (4)

C) Calculate and draw the magnitude response of the system given by the difference equation (4)

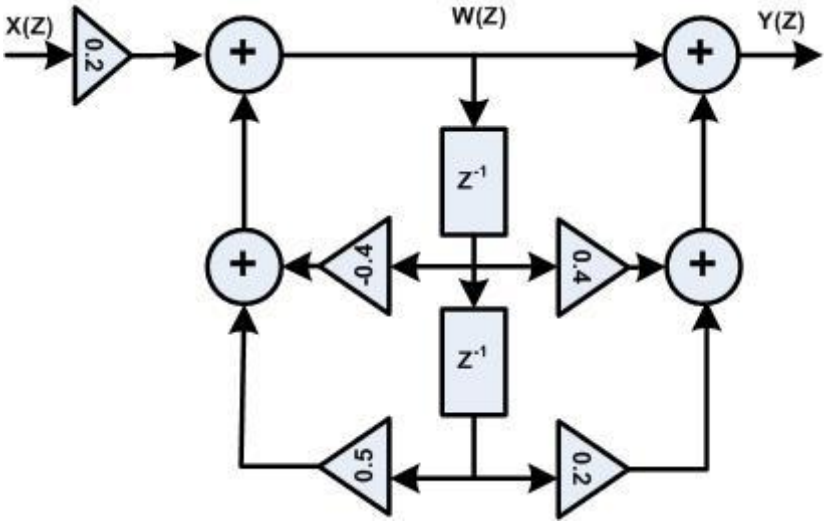
$$y(n) = 0.159\,x(n) + 0.225\,x(n-1) + 0.25\,x(n-2) + +0.225\,x(n-3) + 0.159\,x(n-4).$$

[CO3, BL4, PO4]

4) Why Gibbs oscillations are developed in rectangular window and how can it be eliminated or reduced? [CO3, BL2, PO2] (2)

A)

B) Estimate the transfer function for the following structure. [CO4, BL2, PO2] (3)



C) Design a linear phase FIR bandpass filter to pass frequencies in the range 200 Hz and 400 Hz by taking 5 samples of Hamming window sequence (take sampling frequency= 1000 Hz) [CO3, BL6, PO4] (5)

5) For a given impulse response, draw the structure of linear phase FIR filter for N=11. (4)

A) $h_d(n) = sin\frac{(0.3\pi(n-5))}{(n-5)\pi} - sin\frac{(0.6\pi(n-5))}{(n-5)\pi}$. [CO4, BL3, PO3]

B) Draw the cascaded structure for the following transform function and mention its advantages. (3)

$$H(z) = \frac{1-\frac{1}{2}z^{-1}}{1-\frac{7}{8}z^{-1}+\frac{3}{32}z^{-2}}$$ [CO4, BL3, PO3]

C) Illustrate various key phases required to process audio signal and explain. [CO5, BL4, PO4] (3)

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