

Code No: 56027

R09

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY, HYDERABAD

B. Tech III Year II Semester Examinations, May - 2015

DIGITAL SIGNAL PROCESSING

(Electronics and Communication Engineering)

Time: 3 hours

Max. Marks: 75

Answer any five questions
All questions carry equal marks

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1. A casual system is represented by the following difference equation:
$$y(n) + \frac{1}{4}y(n-1) = x(n) + \frac{1}{2}x(n-1).$$
 Find the system transfer function $H(z)$, unit sample response, magnitude and phase function of the system. [15]

- 2.a) State and prove the following properties of DFT:
i) Linearity ii) Frequency shifting.
b) Explain the following:
i) Overlap Add Method ii) Overlap Same Method. [5+10]

- 3.a) Develop the DIF FFT algorithm for $N=8$. Using the resulting signal flow graph compute the 8-point DFT of the sequence $x(n) = \sin\left(\frac{\pi}{2}n\right), 0 \leq n \leq 7$.

- b) If $x_2(n) = x_1(-n)$ without performing FFT find $X_2(k)$ using $X_1(k)$ [10+5]

- 4.a) Determine direct forms I and II for the second order filter given by:
$$y(n) = 2b \cos \omega_0 y(n-1) - b^2 y(n-2) + x(n) - b \cos \omega_0 y(n-1).$$

- b) Obtain cascade realization of the system function:

$$H(z) = \left(1 + \frac{1}{2}z^{-1} + z^{-2}\right) \left(1 + \frac{1}{2}z^{-1} + z^{-2}\right). \quad [8+7]$$

- 5.a) Design a digital IIR low pass Butterworth filter that has a 2db pass band attenuation at a frequency of 300π rad/sec and atleast 60db stop band attenuation at 4500π rad/sec. Use backward reference transformation.

- b) Determine the order and the poles of a type-I low pass Chebyshev filter that satisfies the following constraints

$$0.8 \leq |H(\omega)| \leq 1, \quad 0 \leq \omega \leq 0.2\pi$$

$$\text{And } |H(\omega)| \leq 0.2 \quad 0.6\pi \leq \omega \leq \pi$$

[8+7]

- 6.a) Determine the transfer function $H(Z)$ of an FIR filter to implement.
$$h(n) = \delta(n) + 2\delta(n-1) + \delta(n-2)$$
 using frequency sampling techniques.

- b) Give the comparison between FIR and IIR filters with examples. [10+5]

- 7.a) Consider a single stage interpolator with the following specifications:
Original sampling rate = 1KHz
Interpolation factor $L=2$
Frequency of interest = 0-150Hz
Passband ripple = 0.02 dB
Stopband attenuation = 45 dB
- Draw the block diagram for the interpolator
 - Determine the window type filter length and cutoff frequency, if the window method is used for the anti-image FIR filter design.
- b) Explain about multi rate signal processing and give its examples. [8+7]
8. Explain the characteristics of a limit cycle oscillation with respect to the system described by the equation $y(n) = 0.85y(n-2) + 0.72y(n-1) + x(n)$
- Determine the Dead band of the filter $x(n) = \frac{3}{4}\delta(n)$ [15]

