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BT-5/D-22 **45246**

DIGITAL SIGNAL PROCESSING

Paper–EC-309A

Time : Three Hours] [Maximum Marks : 75

Note : Attempt *five* questions selecting at least *one* question from each unit.

UNIT–I

1. (a) Obtain z-transform for (i) $x1\ (n) = (1/2)n\ u(n) + (2)\ n\ u(n)$ (ii) $x2(n) = -an\ u(-n\ -1)$. Plot pole - zero diagram and state ROC for both. 7

(b) Determine the inverse z-transform of the function $z\,x(z) = z/(z - 0.5), \mid z \mid > 0.5$ using long division method. 8

2. (a) Explain the following : (i) Goertzel Algorithm and (ii) Chirp Z Transform. Derive the expression for both. 8

(b) An LT1 system has impulse response $h(n) = 5\ (-1/2)\ n\ u(n)$. Check whether the system is causal and stable. 7

UNIT–II

3. (a) Find the DFT of the following sequence $x(n)$ using DFT FFT 7

$x(n) = (1, -1, -1, -1, 1, 1, 1, -1)$.

(b) Determine the response of LT1 system when the input sequence $x(n) = \{-1, 1, 2, 1, -1\}$ by radix 2 DIT FFT. The impulse response of the system is $h(n) = \{-1, 1, -1, 1\}$. 8

4. Determine the cascade and parallel realizations for the system described by the system function 15

$$H(z) = \frac{10\left(1-\frac{1}{2}z^{-1}\right)\left(1-\frac{2}{3}z^{-1}\right)(1+2z^{-1})}{\left(1-\frac{3}{4}z^{-1}\right)\left(1-\frac{1}{8}z^{-1}\right)\left[1-\left(\frac{1}{2}+j\frac{1}{2}\right)z^{-1}\right]\left[1-\left(\frac{1}{2}-j\frac{1}{2}\right)z^{-1}\right]}$$

UNIT–III

5. Draw three different FIR structures for the $H(z)$ given below :

$H(Z) = (1 + 5Z - 1 + 6Z - 2)(1 + Z - 1)$. 15

6. Using a rectangular window technique, design a low pass FIR filter with passband gain unity, cutoff wavelength 1000 Hz working at sampling frequency of 5 KHZ. Length of impulse response should be 7. 15

UNIT–IV

7. Design an IIR filter using bilinear transformation method. 15

8. Design a digital second order low pass Butterworth IIR filter with cut off frequency 2200 Hz using bilinear transformation. The sampling rate is 8000 Hz. 15