[Total No. of Questions - 8] [Total No. of Printed Pages - 3] (2125)

15409

M. Tech 3rd Semester Examination

Digital Signal Processing (NS)

EC-304

Time : 3 Hours **Max. Marks : 100**

The candidates shall limit their answers precisely within the answer-book (40 pages) issued to them and no supplementary/continuation sheet will be issued.

Note : Attempt any five questions.

1. (a) Obtain direct form I, Direct form II, cascade, parallel and transposed direct form II structures for the following system:

$$y(n) = y(n-1) - \frac{1}{2}y(n-2) + x(n) - x(n-1) + x(n-2) \quad (10)$$

(b) Explain the design procedures for FIR & IIR filters. (10)

2. (a) Determine the z-transform of the signal $x(n) = (-1)^n \cos\left(\frac{\pi n}{3}\right) u(n)$. State the properties of z-transform along with their physical significance. (12)

(b) What is the relationship between Fourier transform and Z-transform? Discuss applications of both the transforms. (8)

3. (a) Compute the N-point DFTs of the signals:

(i) $x(n) = \delta(n - n_0)$ $0 < n_0 < N$

(ii) $x(n) = e^{\left\{j\frac{2\pi}{N}k_0\right\}}$ $0 \le n \le N - 1$ (8)

[P.T.O.]

(b) Show how linear convolution can be calculated using DFT. (12)

4. (a) What are minimum phase, Maximum phase, and mixed phase systems? (8)

(b) Determine $|H(\omega))|^2$ for the system

$y(n) = -0.1y(n - 1) + 0.2y(n - 2) + x(n) + x(n - 1)$ (12)

5. (a) Explain the differences between the discrete sinusoidal signal and continuous time sinusoidal signals in reference to frequency of the sinusoidal signal. Also justify that a discrete frequency is dimension less quantity and have units of that of an angle. (10)

(b) Explain in detail the Reconstruction filter design. (10)

6. (a)) Evaluate the unit step response for the LTI system represented by the impulse response $h(n) = \left(\frac{1}{4}\right)^n u(n)$. (5)

(b) Find the inverse Fourier transform of

$X(\omega) = 2 + e^{-j\omega} + 3e^{-j\omega} + 4e^{-j4\omega}$. (5)

(c) State and prove the time shifting and circular convolution properties of Discrete Fourier Transform DFT. (10)

7. (a) Convert the analog filter with the system function

$$H_a(s) = \frac{s + 0.1}{(s + 0.1)^2 + 9}$$

into a digital IIR filter by means of impulse in variance method. (8)

(b) Explain in detail the FIR filter design based on frequency sampling approach. (12)

8. Write short notes on : (any four)

(i) Linear phase filters.

(ii) Sample and Hold circuits.

(iii) Complementary transfer functions.

(iv) LTI discrete time systems.

(v) Methods for computing FFT. (5×4=20)