

GUJARAT TECHNOLOGICAL UNIVERSITY**BE- VIIth SEMESTER-EXAMINATION – MAY/JUNE- 2012****Subject code: 171003****Date: 09/06/2012****Subject Name: Digital Signal Processing****Time: 02:30 pm – 05:00 pm****Total Marks: 70****Instructions:**

1. Attempt all questions.
2. Make suitable assumptions wherever necessary.
3. Figures to the right indicate full marks.

- Q.1** (a) For each of the following systems, determine whether the system is (1) Stable (2) Causal (3) Linear (4) Time invariant **07**
- (i) $y[n] = x[n] + 3u[n+1]$
- (ii) $y[n] = x[Mn]$ M is an integer, greater than 1.
- (b) List the properties of the region of convergence for the Z transform. **07**

- Q.2** (a) Compute the linear convolution of the following sequences graphically: **07**
- $h[n] = \{1, 2, 1, -1\}$, $x[n] = \{1, 2, 3, 1\}$
- (b) Determine the inverse Z-transform. **07**

$$X(z) = \frac{1 - \frac{1}{2}z^{-1}}{1 + \frac{3}{4}z^{-1} + \frac{1}{8}z^{-2}}, \quad |z| > 1/2$$

OR

- (b) The system function of a causal linear time invariant system is **07**
- $$H(z) = \frac{1 - z^{-1}}{1 + \frac{3}{4}z^{-1}}$$

The input to this system is $x[n] = \left(\frac{1}{3}\right)^n u[n] + u[-n-1]$.

- (a) Find the impulse response of the system, $h[n]$.
- (b) Find the output $y[n]$.
- (c) Is the system stable?

- Q.3** (a) Draw a signal flow graph implementing the system function **07**

$$H(z) = \frac{1 + 2z^{-1} + z^{-2}}{1 - 0.75z^{-1} + 0.125z^{-2}} \text{ as a}$$

- (i) parallel form structure using a second order system
- (ii) cascade form structures.

- (b) Determine the z transform, including the ROC of the sequence **07**

$$x[n] = \left(-\frac{1}{3}\right)^n u[n] - \left(\frac{1}{2}\right)^n u[-n-1]$$

OR

- Q.3** (a) Draw a cascade form structure for the system function **07**

$$H(z) = 1 + \frac{5}{2}z^{-1} + 2z^{-2} + 2z^{-3}$$

- (b) Discuss frequency domain representation of sampling. **07**

- Q.4** (a) Compare FIR and IIR filters. **07**

- (b) For the given two 4 point sequence x[n] and h[n] where **07**

$$x[n] = \cos\left(\frac{\pi n}{2}\right) \quad n=0,1,2,3$$

$$h[n] = 2^n \quad n=0,1,2,3$$

(i) Calculate 4-point DFT of x[n].

(ii) Calculate 4-point DFT of h[n].

OR

- Q.4** (a) The desired response of a low pass filter is **07**

$$H_d(e^{j\omega}) = e^{-3j\omega} \text{ for } |\omega| < |\omega_c|$$

$$= 0 \text{ otherwise}$$

Determine H(e^{jw}) for M= 7 using Hamming window.

Wc = 1 rad/sec.

- (b) Sketch the six point circular convolution of following sequences. **07**

$$x_1[n] = \{1, 2, 3, 4, 5, 6\} \quad x_2[n] = \{0, 0, 1\}$$

- Q.5** (a) Discuss decimation in time FFT algorithm for radix-2. **07**

- (b) Explain IIR filter design by Bilinear Transformation method. **07**

OR

- Q.5** (a) Discuss decimation in frequency FFT algorithm for radix-2. **07**

- (b) List the properties of DFT. Prove any two properties. **07**
