Seat No.: _____ Enrolment No._____

# GUJARAT TECHNOLOGICAL UNIVERSITY

**BE- VII$^{th}$ 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**

$$h[n] = \{1, \underset{\uparrow}{2}, 1, -1\} \quad , \qquad x[n] = \{\underset{\uparrow}{1}, 2, 3, 1\}$$

**(b)** Determine the inverse Z-transform. **07**

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

**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**

$$H(z) = \frac{1 + 2z^{-1} + z^{-2}}{1 - 0.75z^{-1} + 0.125z^{-2}}$$ 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]= $2^n$ 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**

$$H_d\left(e^{jw}\right)=e^{-3jw}\, for\, |w|<|w_c|$$

=0 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**

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

**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**

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