Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

M. E. - SEMESTER – II • EXAMINATION – WINTER 2012

Subject code: 1720702 **Date: 31-12-2012**

Subject Name: Digital Signal processing

Time: 10.30 am – 01.00 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)** Explain linear convolution with the help of following sequences. **07**

$h[n]= \{ \underset{\uparrow}{1}, 1, 1\}$; $x[n]= \{\underset{\uparrow}{1}, 1, 1 \}$

(b) Explain how can we determine the system is liner time invariant or not? Determine the following systems are liner time invariant or not. **07**

(i) $y(n) = x(n) – x(n-1)$

(ii) $y(n) = x(n)^2$

Q.2 **(a)** Explain finite word length effects in FIR digital filters. **07**

(b) Find the z-transform of each of the following sequences: **07**

(i) $x(n) = 2^n u(n) +3(0.5)^n u(n)$

(ii) $x(n) = \cos(n\omega_o)\, u(n)$

OR

(b) Explain region of convergence in Z-transform. Explain and prove following properties of Z Transform. **07**

(i) Time shifting property,

(ii) Frequency shifting property.

Q.3 **(a)** Find the z-transform of $x(n) = 0.5^n u(n) - 2^n u(-n-1)$, and find another signal that has the same z-transform but a different region of convergence. **07**

(b) Find the circular convolution of two sequence of **07**

$x(n)= \{0, 1, 2, 3\}$; $h(n)= \{ 2, 1, 0, 2\}$

OR

Q.3 **(a)** Illustrate the computation of an 8-point DFT using three stages. Further extend it to eight point decimation-in-time FFT algorithm. Show basic butterfly computation. **07**

(b) Discuss the problems and issues related with estimation of the power density spectrum of a signal from the observation of the signal over a finite time interval. **07**

Q.4 **(a)** Explain lattice ladder structure for FIR filters. **07**

(b) A causal linear shift-invariant system is characterized by the difference equation **07**

$y(n) = 0.25y(n - 1) +0.125\, y(n - 2) + x(n) - x(n - 1)$

Find the system function, H(z), and the unit sample response, h(n).

OR

Q.4 **(a)** Give detail comparison between FIR and IIR filter **07**

Q.4 **(b)** Consider the first-order system **07**

$$y(n) = -a_1 y(n-1) + b_0 x(n) + b_1 x(n-1)$$

Draw and explain the realization of this system using:

(i) Direct Form I structure
(ii) Direct Form II structure

Q.5 **(a)** What is multi-rate digital signal processing? Give its examples and list various advantages of it. **07**

(b) List the various DSP application areas. Discuss DSP applications to radar engineering in detail. **07**

OR

Q.5 **(a)** Explain Periodicity, Linearity and Symmetry properties of the DFT. **07**

(b) In which way DSP-processors are different from general purpose processors. With the help of a neat sketch, explain Digital Signal Processor architecture. **07**

****