

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

$\begin{matrix} & \uparrow & & \uparrow \\ & \text{h[n]} & & \text{x[n]} \end{matrix}$

(b) Explain how can we determine the system is liner time invariant or not? **07**
Determine the following systems are liner time invariant or not.
(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) $x(n) = \cos(n\omega_0) u(n)$

OR

(b) Explain region of convergence in Z-transform. Explain and prove following **07**
properties of Z Transform.
(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 **07**
that has the same z-transform but a different region of convergence.

(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 **07**
extend it to eight point decimation-in-time FFT algorithm. Show basic butterfly computation.

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

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

(b) A causal linear shift-invariant system is characterized by the difference **07**
equation
 $y(n) = 0.25y(n-1) + 0.125y(n-2) + x(n) - x(n-1)$
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**
