Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

M. E. - SEMESTER – II • EXAMINATION – WINTER • 2013

Subject code: 1720702 Date: 27-12-2013

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)** Define **07**

i) FIR system
ii) IIR system
iii) Recursive system
iv) Shift invariance system

(b) Obtain direct form-I and direct form –II realization of a system described by following difference equation: **07**

$$y(n)-3y(n-1)-4y(n-2)=x(n)+2x(n-1).$$

Q.2 **(a)** Define ROC. Explain and prove following properties of Z Transform. (a) Time Shifting (b) scaling in Z-domain (c) Time reversal. **07**

(b) Determine Z-transform of following functions and specify ROC. **07**

(i) $x(n)= [3(2)^n – 4(3)^n]u(n)$

(ii) $x(n)= \cos(\omega_0 n)u(n)$

OR

(b) Explain how the causality of the system can be studied from region of convergence. Using Z-transform, determine **the response** of a system described by difference equation: **07**

$$y(n) = (5/6)y(n-1) – (1/6)y(n-2) + x(n)$$

when input $x(n) =\delta(n) –(1/3)\ \delta(n-1)$.

Q.3 **(a)** Explain Linearity, causality and stability of discrete time system with example. **07**

(b) The LTI system initially at rest is described by the difference equation $y(n)= (1/4)y(n-1) + x(n)$. What is the impulse response of this system? Determine the parallel form realization of this system. **07**

OR

Q.3 **(a)** The impulse response of a linear time invariant system is h(n)=[4,3,2,1]. Using convolution, determine the response of the system subject to input signal x(n)=[1,2,3,1]. Both h(n) and x(n) samples are given starting from n=0. **07**

(b) Convert the analog filter with system function **07**

$Ha(s)= \dfrac{(s+0.1)}{(s+0.1)^2+16}$ into a digital IIR filter by means of the bilinear transformation.

Q.4	**(a)**	Determine the response of FIR filter having the impulse response h(n)=[1,2,3] to the input sequence x(n)=[1,2,2,1] using circular convolution. Both h(n) and x(n) samples are given starting from n=0.	**07**
	(b)	Describe decimation in frequency algorithm to find DFT and draw the signal flow graph for N=8.	**07**
		OR	
Q.4	**(a)**	Compute 8-point DFT of x(n)=[1,0,1,1,0,1,1,1] using decimation in time algorithm.	**07**
Q.4	**(b)**	Write a note on digital filter bank.	**07**
Q.5	**(a)**	Compare and contrast FIR and IIR Filter. Give advantage of each.	**07**
	(b)	Discuss the Notch filter, give pole-zero diagram and explain how the notch bandwidth can be reduced.	**07**
		OR	
Q.5	**(a)**	Explain Harvard architecture and Pipelining for DSP processor.	**07**
	(b)	When sectional convolution is used? Explain overlap-add method.	**07**

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