Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

PDDC – SEMESTER – VI • EXAMINATION – SUMMER 2015

Subject Code: X61103 **Date: 14/05/2015**

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 impulse response of LTI system. Explain how from the impulse response the frequency response of the LTI system can be determined. **07**

(b) A discrete time signal x(n) is given below: **07**

$x(n) = \{1, \underset{\uparrow}{1}, 1, 1, 1, {}^{1}/_{2}\}$

Sketch and label carefully each of the following signals:

(1) x(n + 3) (2) x(n - 3) (3) x(6 - n)

(4) x(3n + 1) (5) x(n/2)

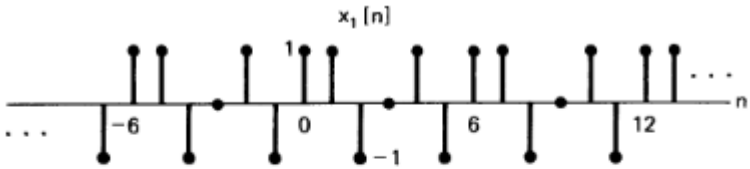
Q.2 **(a)** A system has output $y(n) = x(n) \sin(n\pi/3)$ **07**

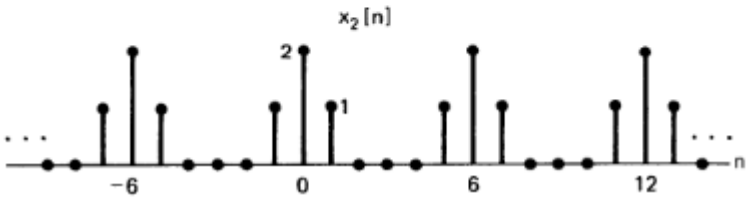
Check the system for linearity, causality, timevariance, Static, Stability and Invertability.

(b) A system has input sequence x(n) = {**1**,2,3,4} and output sequence y(n) = {**1**,4,8,11,9 ,1,-4}then find out the system h(n) from input and output sequence by using linear convolution method. **07**

OR

(b) Consider the signal $x_1[n]$ and $x_2[n]$ depicted in following figure. These signals are periodic with period 6. Compute and sketch their periodic convolution using No = 6. **07**



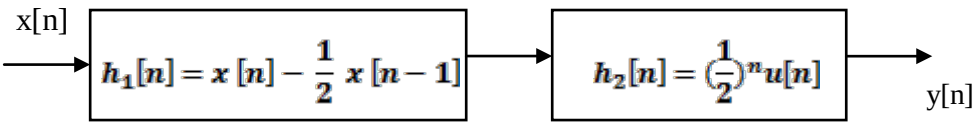


Q.3 **(a)** Define Z transform. Explain the following properties of Z transform: **07**

(i) Multiplication of an exponential Sequence

(ii) Differentiation of X(Z)

(b) Find out the impulse response of following block diagram if x[n] is input and y[n] is output sequence. **07**



OR

Q.3 **(a)** The transfer function of discrete system is given following: **07**

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

Find out the inverse z transform and Define the ROC for system stability and causality.

(b) Explain the sampling theorem and Find out Nyquiest rate for following signal: **07**

$X_1(t) = (\text{Sin}200\pi t)/\pi t$

$X_2(t) = 5 \text{ Cos } 1000\pi t \text{ Cos } 4000\pi t$

Q.4 **(a)** Enlist the properties of Discrete time Fourier Transform. Also determine the frequency spectrum of signal $x(n) = a^n u(n)$. **07**

(b) Compare FIR and IIR filter. **07**

OR

Q.4 **(a)** State and Prove the properties of DFT: (1) Periodicity (2) Time shifting. **07**

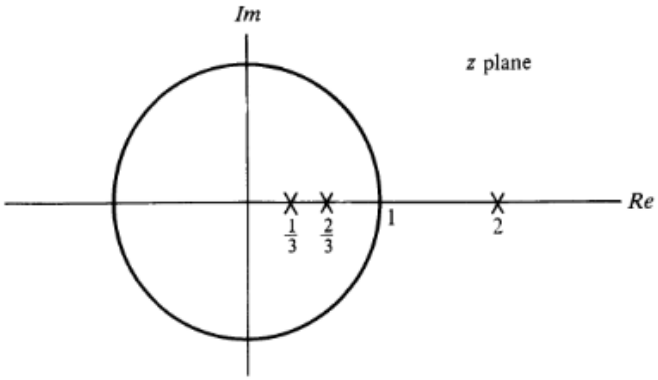
(b) Draw the direct form I and Direct form II structure for difference equation **07**

$$y[n] - \frac{1}{2}y[n-1] + \frac{1}{4}y[n-2] = x[n] - x[n-1]$$

Q.5 **(a)** (1) Find the 4 – Point DFT of x[n] = {1, -2, 3, 2} **07**

(2) Find the IDFT of X(k) = {1, 0, 1, 0}

(b) Pole zero plot for the z- transform X(z) of x[n] is shown as following figure: **07**



Determine what can be inferred about the associated region of convergence from each of following statement

(1) x[n] is right sided
(2) The fourier transform of x[n] converges
(3) The fourier transform of x[n] does not converges
(4) x[n] is left sided.

OR

Q.5 **(a)** Explain the Decimation in time FFT algorithm. **07**

(b) Explain the Architecture of DSP processor **07**

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