Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

ME - SEMESTER– I (New course)• REMEDIAL EXAMINATION – SUMMER 2015

Subject Code: 2712910 **Date:15/05/2015**

Subject Name: Discrete Time Signal Processing

Time: 10:30 am to 1:00 pm **Total Marks: 70**

Instructions:

1. **Attempt all questions.**
2. **Make suitable assumptions wherever necessary.**
3. **Figures to the right indicate full marks.**
4. **Notations/ symbols used have usual meaning.**

Q.1 (a) **06**

State the sampling theorem. Given $x(t) \overset{FT}{\longleftrightarrow} X(w)$,for the spectrum of the continuous-time signal, shown in Fig.1, consider the three cases $f_s = 2f_x$; $f_s > 2f_x$ and $f_s < 2f_x$; draw the spectra, indicating aliasing for all three cases.

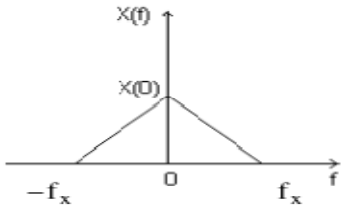

Fig.1

(b) Do as directed : (02 marks each) **08**

(i) State equation for a backward difference system. Will it be causal?

(ii) Define DFT. State its two applications.

(iii) Discuss significance of aliasing for sampling.

(iv) For the signal shown in the fig.2 .Evaluate the integral $\int_{-\pi}^{\pi} \left|X\left(e^{j\omega}\right)\right|^2 d\omega$.

Fig.2

Q.2 (a) Draw and explain the block diagram of basic generic hardware architecture for a digital signal processor. **07**

	(b)	Describe the Kaiser window filter design procedure for a high pass filter.	**07**
		OR	
	(b)	Describe Implementation of a DSP algorithm.	**07**
Q.3	**(a)**	Define convolution. Let x(n) = ŭ(n) +2ŭ(n-1)-ŭ(n-3) and h(n) = 2 ŭ(n+1) +2ŭ(n-1) Compute and plot the following convolution. (i) $y_1(n) = x(n) * h(n)$ (ii) $y_2(n) = x(n+2) * h(n)$	**07**
	(b)	Discuss various properties of the Z-transform.	**07**
		OR	
Q.3	**(a)**	An LTI system is characterized by y(n) ï ay(n-1) = x(n); determine its frequency and impulse response using DTFT.	**07**
	(b)	State and prove initial value theorem and final value theorem for Z-transform. Obtain the initial value for $x(z) = 2 + 3z^{-1} + 4z^{-2}$.	**07**
Q.4	**(a)**	Consider a LTI system with system function as follows: $Z(s) = (1+2z^{-1} + z^{-2}) / (1 - 0.75 z^{-1} + 0.125 z^{-2})$. Obtain (i) Direct form ï I and (ii) Direct form ï II structure. Comments on the result obtained.	**07**
	(b)	With help of signal flow graph, discuss structure of Linear phase FIR system.	**07**
		OR	
Q.4	**(a)**	For H (z) = 2/(z+3), obtain Direct form - II and its transposed realization.	**07**
Q.4	**(b)**	For linear phase FIR filters, how constant group and phase delay is achieved? Also, enlist various design techniques for linear phase FIR filter. .	**07**
Q.5	**(a)**	State and prove various properties of DFT.	**07**
	(b)	Design an IIR filter from continues time filter.	**07**
		OR	
Q.5	**(a)**	Discuss Decimation in frequency FFT algorithm.	**07**
	(b)	Discuss Linear convolution using DFT.	**07**

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