Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

ME – SEMESTER I (NEW) – • EXAMINATION – SUMMER 2016

Subject Code: 2712910 **Date:19/05/2016**

Subject Name: Discrete Time Signal Processing

Time:02:30 pm to 05:00 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 Do as directed : (02 marks each) **14**

(i) Draw low-pass filter magnitude characteristics with all tolerance limits.
(ii) Define DFT. State its two applications.
(iii) Discuss significance of Nyqist rate for sampling.
(iv) State and prove differentiation property of Fourier Transform
(v) State a equation for a forward and back ward difference systems.
(vi) Prove that $\delta(n) = u(n) - u(n-1)$.
(vii) Evaluate $\delta(n-1) * \delta(n+1)$ .Plot the resultant sequence.

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

(b) Discuss discrete time processing of continuous time signals. **07**

OR

(b) Define and explain aliasing. Describe remedies for the same. **07**

Q.3 **(a)** 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**

(b) Consider a LTI system with system function as follows: **07**
$Z(s) = (1+2z^{-1} + z^{-2}) / (1 - 0.75 z^{-1} + 0.125 z^{-2})$. Obtain (i) Direct form –I and (ii) Direct form –II structure. Comments on the result obtained.

OR

Q.3 **(a)** With help of signal flow graph, discuss structure of Linear phase FIR system **07**

(b) Discuss various properties of ROC of the Z-transform. **07**

Q.4 **(a)** For linear phase FIR filters, how constant group and phase delay is achieved? Also, enlist various design techniques for linear phase FIR filter. **07**

(b) Obtain relation between z- transform and discrete Fourier transform. **07**

OR

Q.4 **(a)** Consider a causal system whose input and output satisfy the difference equation $y(n) - a\,y(n-1) = x(n)$.(i) Find H(z) , ROC and condition(s) for stability. (ii) Plot detailed pole-zero diagram.(iii) Given system is IIR or FIR? Why? **07**

(b) State and prove the following properties of DFT: (i) linearity (ii) duality (iii) periodicity (iv) circular convolution. **07**

Q.5 **(a)** For the system $T\{x(n)\} = a\,x(n) + b$, determine whether the system is (i) stable (ii) causal (iii) linear (iv) time –invariant and (v) memory less or not. **07**

(b) Discuss Decimation in Frequency FFT algorithm. **07**

OR

Q.5 **(a)** Describe the Kaiser window filter design procedure for a high pass filter **07**

(b) Write short note on: Hilbert Transform. **07**

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