Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

BE – SEMESTER – V (NEW) EXAMINATION – WINTER 2015

Subject Code: 2150307 **Date:10/12/ 2015**

Subject Name: Digital Signal Processing

Time:10:30am to 1:00pm **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) What is signal processing? Explain the advantages and disadvantages of Digital signal processing over Analog signal processing. **07**

(b) For the following system, determine whether the system is stable,causal,linear,time-invariant,memoryless: **07**

$$T\{x(n)\} = \sum_{k=n-n_0}^{n+n_0} x(k)$$

Q.2 (a) Discuss aliasing in discrete time systems. **07**

(b) Determine the particular solution of the difference equation **07**

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

When the forcing function is $x(n) = 2^n u(n)$.

OR

(b) Let $X(e^{jw})$ denote the fourier transform of the signal x(n) .Perform the following calculations without explicitly evaluating $X(e^{jw})$: **07**

$x(n)=\{-1,\ 0,\ 1,\ \underset{\uparrow}{2},\ 1,\ 0,\ 1,\ 2,\ 1,\ 0,\ -1\}$

(i) Evaluate $X(e^{jw})\big|_{w=0}$

(ii) Evaluate $X(e^{jw})\big|_{w=\pi}$

(iii) Find $\Theta(X(e^{jw}))$

Q.3 (a) Discuss the properties of the Region of Convergence of z-transform. **07**

(b) A causal LTI system has impulse response h(n) , for which the z-transform is **07**

$H(z) = (1 + z^{-1}) / (1 - (1/2)\, z^{-1})\,(1 + (1/4)\, z^{-1})$

(i)What is the region of convergence of H(z) ?

(ii)Is the system stable? Explain.

(iii)Find the impulse response h(n) of the system.

OR

Q.3 (a) Discuss the Direct form- I , Direct form – II , Cascade and Parallel structures to implement the discrete time systems. **07**

(b) Discuss the following for IIR filters: **07**

(i)Zero-input limit cycles

(ii)Limit cycles due to overflow

Q.4 (a) Determine the circular convolution of the sequences using the time domain formula: **07**

$x_1(n) = \{\underset{\uparrow}{1},\ 2,\ 3,\ 1\}$ $x_2(n) = \{\underset{\uparrow}{4},\ 3,\ 2,\ 2\}$

(b) What is Gibbs Phenomena ? Discuss windowing for FIR filters. **07**

OR

Q.4 **(a)** Design a single-pole low pass digital filter with a 3-dB bandwidth of 0.2π, using the bilinear transformation applied to the analog filter **07**

$Ha(s) = \Omega c \ / \ (1 + (s / \Omega c))$

(b) Consider the real finite-length sequence x(n). **07**

$x(n) = \{ \underset{\uparrow}{4}, 3 , 2, 1\}$

(i)Sketch the finite length sequence y(n) whose six-point DFT is $Y(k) = W_6^{4k} X(k)$, Where X(k) is the six-point DFT of x(n).

(ii) Sketch the finite length sequence w(n) whose six-point DFT is $W(k) = Re\{ X(k) \}$

(iii) Sketch the finite length sequence q(n) whose three-point DFT is $Q(k) = X(2k)$, $k=0,1,2$

Q.5 **(a)** Determine y(n) for **07**

$x(n) = \{ \underset{\uparrow}{4}, 3 , 2, 1\}$, $h(n) = \{ \underset{\uparrow}{1}, 2 , 3\}$

using 4-point DFT.Justify the corruption in the result.

(b) Discuss the decimation-in-time FFT algorithm. **07**

OR

Q.5 **(a)** Enlist the applications of DSP. Explain any one application in brief. **07**

(b) Discuss the key features of the architecture of DSP Processors. **07**

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