Seat No.: _____ Enrolment No._____

# GUJARAT TECHNOLOGICAL UNIVERSITY

**PDDC - SEMESTER–VI • EXAMINATION – WINTER 2013**

**Subject Code: X61103** **Date: 09-12-2013**

**Subject Name: Digital Signal Processing**

**Time: 02.30 pm - 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** **(a)** Define the term signal & system. Also give the classification of the signals. **07**

**(b)** Check the given systems for Linearity, Time invariance & Causality: **07**

1) $h(n) = x(2n)$ 2) $x(n) = e^{x(n)}$

**Q.2** **(a)** Explain in brief frequency domain representation of sampling. **07**

**(b)** For the given analog signal $x_a(t) = 3 \cos (100 \pi t)$ **07**

a) Determine the minimum sampling rate required to avoid the aliasing.

b) If the signal is sampled at the rate $F_s$= 200 Hz. What is the discrete time signal obtained after sampling?

c) If the signal is sampled at the rate $F_s$= 75 Hz. What is the discrete time signal obtained after sampling?

**OR**

**(b)** The impulse response of a LTI system is h(n) ={1,**2**,1,-1} **07**

Determine the response of the system to the input signal x(n) = {**1**,2,3,1}

**Q.3** **(a)** Prove the differentiation property in the z domain. Determine the z transform of the signal $x(n) = n\, a^n\, u(n)$ **07**

**(b)** Determine impulse response for the cascade of two LTI systems having impulse responses $h_1(n) = (1/2)^n u(n)$ , $h_2(n) = (1/4)^n u(n)$. **07**

**OR**

**Q.3** **(a)** Solve the followings. **07**

1) Determine the inverse z transform of $X(z) =1/(1-1.5z^{-1} + 0.5z^{-2})$ if ROC $|z| > 1$, $|z| < 0.5$ and $0.5 < |z| <1$.

2) Determine the step response of the causal system described by the diff. equation $y(n) = y(n-1) + x(n)$.

**(b)** Define Fourier transform of discrete time aperiodic signal. Also Determine and sketch the frequency spectrum of the signal $x(n) = a^n u(n)$ **07**

**Q.4** **(a)** Explain the architecture of the DSP Processor. **07**

**(b)** A filter is described by a diff eqn. $y(n) – (3/4) y(n-1) + (1/8) y(n-2) = x(n) + (1/2) x(n-1)$ Draw the direct form I & direct form II realization. **07**

**OR**

**Q.4** **(a)** Explain IIR filter design by bilinear transformation method. **07**

**(b)** Define the DFT & enlist the linearity & periodicity property of the same. Also determine the circular convolution of x(n) ={2,1,2,1} & h(n) = {1,2,3,4}. **07**

**Q.5** **(a)** Discuss the decimation in time FFT algorithm for radix 2. **07**

**(b)** Find the DFT of the sequence x(n)={1,0,0,1} using DIF algorithm. **07**

**OR**

**Q.5** **(a)** Find the number of complex multiplications and complex additions required in the direct computation of 1024 point DFT. How many complex multiplications and complex additions will be required using FFT algorithm? **07**

**(b)** Explain the window functions used in FIR filter design. **07**

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