Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

BE - SEMESTER–VII EXAMINATION – WINTER 2015

Subject Code: 171003 Date: 09/12/2015

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)** With the block diagram explain typical Digital Signal Processing system and also mention the advantages of DSP over ASP. **07**

(b) For each of the following systems, determine whether the system is Static /dynamic, Causal/ Noncausal, Linear/ Nonlinear, Time invariant / Time varient **07**

(i) y[n] = x[n]+ 3u[n+1]

(ii) y[n] = x[a n] where 'a' is any integer greater than 1.

Q.2 **(a)** Define Discrete Fourier series, Discrete time Fourier transform and Discrete Fourier transform and explain the relation between them. **07**

(b) i. The impulse response of the LTI system is h(n)={2,4,5,6}. **07**
↑

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

ii. Find the auto correlation of the discrete sequence
$x(n)= a^n u(n)$ for $0 < a < 1$

OR

(b) What is ROC? Explain the properties of the ROC in Z-Transform. **07**

Q.3 **(a)** Find the z transform of $x(n) = n^2 e^{-2n} u(n)$ using the necessary properties. **07**

(b) Find the solution for the given the difference equation **07**
$y(n) + b^2 y(n-2)=0$ for $n \geq 0$ where $|b| < 1$
and initial conditions are y(-1) = 0, y(-2) = -1

OR

Q.3 **(a)** Draw the structures of the following discrete time system defined by the difference equation $y(n) - \frac{3}{4} y(n-1) + \frac{1}{8} y(n-2) = x(n) + \frac{1}{3} x(n-1)$ **07**

(i) Direct Form-I
(ii) Direct Form-II
(iii) Cascade Form

(b) Explain Inverse system, minimum phase system and all pass system. Determine Inverse of the system characterized by y(n)=0.5y(n-1)+x(n) assuming zero initial conditions. **07**

Q.4 **(a)** Explain Impulse invariant method for IIR Filter design. **07**
Determine H(z) by using by using Impulse invariant method if
$H(S) = \frac{10}{S+2}$ and sampling time is 0.01sec

(b) Determine the Circular convolution of the two sequences $x_1(n)$={2,7,5,8,9} and $x_2(n)$={1,3,2,4,5} **07**

OR

Q.4 **(a)** Using DFT and IDFT method compute linear convolution of two sequences $x_1(n)=\{2,3,5\}$ and $x_2(n)=\{1,3\}$ **07**

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

Q.5 **(a)** A digital low pass Butterworth filter with a 3db bandwidth of 0.2π is to be designed from analog filter whose system response is $H(s) = \frac{\Omega_c}{s+\Omega_c}$. Use bilinear transformation & obtain H(z). **07**

(b) State and prove any four properties of DFT **07**

OR

Q.5 **(a)** Derive the 8 point Radix 2 DITFFT algorithm to compute DFT. Also explain the bit reversal concept in it. **07**

(b) Explain multiplier-Accumulator (MAC) hardware in DSP processors **07**

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