

GUJARAT TECHNOLOGICAL UNIVERSITY**ME Semester –I Examination Feb. - 2012****Subject code: 710422N****Date: 16/02/2012****Subject Name: Digital Signal Processing and Applications****Time: 10.30 am – 01.00 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)** Do as directed **07**
- (1) Sketch the discrete-time sequence defined as : $x(n) = (3 - |n|)[u(-n+2) - u(-n-3)]$.
 - (2) Sketch the even and odd components of the discrete-time signal $x(n) = \{2, 3, 4, 5, 6\}$.
 - (3) Determine whether the signal $x(n) = \sin(62\pi n/10)$ is periodic or not. If periodic, determine its fundamental period.
 - (4) Consider the system described by $y(n) = 8x(n) - 2$. Can this system be linear?
 - (5) Consider a causal LTI system described by the difference equation:

$$y(n) = \frac{3}{4}y(n-1) - \frac{1}{8}y(n-2) + x(n).$$
 Sketch pole-zero plot of the system function.
 - (6) Consider the sequence $x(n) = \{1, 2, 3, 4\}$. Sketch the sequence $x((n-2))_4$; $0 < n < 3$.
 - (7) How many complex multiplications and additions are required to compute 8-point DFT of a sequence using FFT algorithm?
- (b)** Determine the unit step response of the system described the difference equation **07**
- $$y(n) = 0.9y(n-1) - 0.81y(n-2) + x(n)$$
- under the following initial conditions: $y(-1) = y(-2) = 1$.
- Q.2 (a)** Explain the relationship $\omega = \Omega * T$ between frequency variable of continuous time and discrete time signals. **07**
- (b)** Determine the circular convolution of the sequences $x_1(n) = \{1, 1, 1, 1\}$ & $x_2(n) = \{4, 4, 4, 4\}$. **07**
- OR**
- (b)** Obtain the linear convolution of $x(n) = u(n)$ and $h(n) = 2^n u(n)$. **07**
- Q.3 (a)** State and prove convolution property of z-transform. **07**
- (b)** Find Z-transform & ROC for $x(n) = a^n u(n)$; $|a| < 1$. **07**
- OR**
- Q.3 (a)** Define following elementary sequences: **07**
- (1) Unit impulse sequence
 - (2) Unit step sequence
 - (3) Unit ramp sequence
- (b)** Find the stable sequence whose z-transform is $H(z) = \frac{1}{1 - 1.5z^{-1} + 0.5z^{-2}}$. **07**
- Q.4 (a)** Explain DIF-FFT algorithm using signal flow graph. **07**
- (b)** Design a linear phase FIR low pass filter of length seven with cut-off frequency 1 rad/sec using rectangular window. **07**

OR

Q.4 (a) Compute 4–Point DFT of the sequence using DIT–FFT algorithm **07**

$$x(n) = \begin{cases} 1 & ; 0 \leq n \leq 3 \\ 0 & ; otherwise \end{cases}$$

(b) Using bilinear transformation, design a Butterworth filter which satisfies the following conditions: **07**

$$0.8 \leq |H(e^{jw})| \leq 1 \quad 0 \leq w \leq 0.2\pi$$

$$|H(e^{jw})| \leq 0.2 \quad 0.6\pi \leq w \leq \pi$$

Q.5 (a) Compare the fixed point and floating point arithmetic for DSP Processors. **07**

(b) Compare FIR and IIR filter designs. **07**

OR

Q.5 (a) Describe windowing method for FIR filter design. **07**

(b) With the help of neat sketch, explain Digital Signal Processor architecture. **07**
