

GUJARAT TECHNOLOGICAL UNIVERSITY**BE SEM-VII Examination-Nov/Dec.-2011****Subject code: 171003****Date: 24/11/2011****Subject Name: Digital Signal Processing****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) Check the following systems for time invariance and linearity **06**

i) $y(n) = n[x(n)]^2$ ii) $y(n) = x(n)\cos(n\pi/4)$

(b) Find convolution of two sequences **08**

i) $x(n) = (-1)^n u(n)$ and $h(n) = u(n)$

ii) $x(n) = [1, 2, 4]$ and $h(n) = [1, 1, 1, 1]$

Q.2 (a) Explain impulse response and step response of a system. **07**
Find the step response of a system whose impulse response is $h[n] = a^{-n}u(-n)$ for $0 < a < 1$

(b) Define Stability of Discrete Time System. Derive the necessary and sufficient condition to test the stability. **07**
Test the stability of a system whose Impulse response is $h[n] = a^n u[n]$.

OR

(b) Define DTFT. Using DTFT, find impulse response of a LTI system described by difference equation **07**
 $y(n) - \frac{1}{2}y(n-1) = x(n) - \frac{1}{4}x(n-1)$

Q.3 (a) State and prove the differentiation property of Z transform. **06**
Using this property, determine Z transform and ROC of signal $x(n) = na^n u(n)$

(b) Calculate DTFT of following signals **08**
i) $x(n) = [\frac{1}{4} \ \frac{1}{4} \ \frac{1}{4} \ \frac{1}{4}]$
ii) $x(n) = 2(\frac{3}{4})^n u(n)$

OR

Q.3 (a) State and prove time shifting property of Z transform. **07**
Using this property, determine Z transform and ROC of signal $x(n) = (4)^{n+2}u(n-1)$

(b) Find inverse Z transform of **07**
 $z(z^2 - 4z + 5)$

$$X(z) = \frac{z(z^2 - 4z + 5)}{(z-1)(z-2)(z-3)}$$

For ROC i) $2 < |z| < 3$ ii) $|z| < 1$

- Q.4 (a)** Discuss the relationship of DFT with Z transform and DFS **07**
 Calculate 4 point DFT of sequence

$$x(n) = \sin(n\pi/2) \quad \text{for } n=0,1,2,3$$
- (b)** i) Find inverse DFT of $X(k) = [1 \ 2 \ 3 \ 4]$ **07**
OR
- Q.4 (a)** Obtain Direct Form I & II realization of a system described **07**
 by

$$y(n) - 1/6 y(n-1) + 1/3 y(n-2) = x(n) + 2x(n-2)$$
- Q.4 (b)** What is circular convolution? How is it different from **07**
 linear convolution? Determine the circular convolution of
 two sequences

$$x(n) = \cos(\pi n/2) \quad \text{for } n=0,1,2,3$$

$$h(n) = 2^n \quad \text{for } n=0,1,2$$
- Q.5 (a)** Develop radix 2 FFT algorithm using decimation in time **07**
 approach. Compute 4 point DFT of sequence
 $x(n) = [1 \ 1 \ 1 \ 1]$ using DIT FFT algorithm.
- (b)** List the various methods of designing IIR filter. Explain the **07**
 bilinear transformation method of designing of IIR filter.
 How does this method overcome the limitation of other
 methods?
- OR**
- Q.5 (a)** Write short note on **08**
 i) Windowing
 ii) Concept of Sampling and aliasing in sampled
 system
- (b)** With help of block diagram explain architecture of **06**
 TMS320C6XXX processor
