

T.E (E+VX) VI Rev 31/5/2012
Discrete Time Signal & System

Con. 4536-12.

GN-8624

(3 Hours)

[Total Marks : 100

- N.B.** (1) Questions No. 1 is **compulsory**.
(2) Attempt any **four** questions from the remaining **six** questions.

1. a) Find the Z-transform and hence DFT of:- $x(n) = \left(\frac{1}{4}\right)^n u(n+4)$ 5
- b) Find the magnitude and phase response of the system described by the difference equation:- 5

$$y(n) = x(n) + \frac{1}{3}x(n-1) + \frac{1}{6}x(n-2)$$
- c) Derive Parseval's Energy Theorem. Also state the significance of the same. 5
- d) Calculate the speed improvement factor in calculating 256 point DFT of a sequence using direct computation and using FFT algorithm. 5
2. a) Find Energy/Power of the following signals:- 8
 i) $x(n) = \begin{cases} \left(\frac{1}{3}\right)^n & \text{for } n \geq 0 \\ 3^n & \text{for } n < 0 \end{cases}$ ii) $x(n) = 3 \cos(4\pi n + \theta)$
- b) Test the following systems for linearity and time invariance:- 6
 i) $y(n) = a^{x(n)}$ ii) $y(n) = 2x(n) + \frac{1}{x(n-1)}$
- c) Determine the transfer function, impulse response and step response for the system given by:- 6

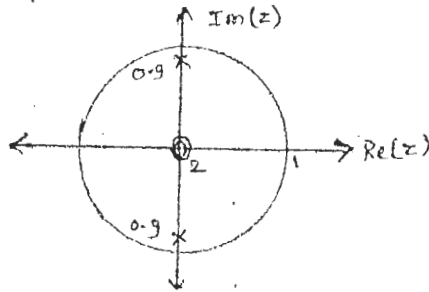
$$y(n) = y(n-1) + x(n) + x(n-1)$$
3. a) Determine the inverse ZT for $X(Z) = \frac{z}{3z^2 - 4z + 1}$ ROC $|Z| > 1$ 8
- b) Obtain Cascade and Parallel realization of the second order DT linear system defined by:- 12

$$y(n) - \frac{3}{4}y(n-1) + \frac{1}{8}y(n-2) = x(n) + \frac{1}{3}x(n-1)$$
4. a) Determine the circular convolution of the two sequences $x_1(n)$ and $x_2(n)$ if- 10
 $x_1(n) = \delta(n) + \delta(n-1) - \delta(n-2) - \delta(n-3)$ and
 $x_2(n) = \delta(n) - \delta(n-2) + \delta(n-4)$

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b) For the pole-zero plot of a system shown below:-

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- i) Find the equation of magnitude response
- ii) Plot the magnitude response
- iii) Identify the type of system based on pass band.

5. a) Given $x(n) = 2^n$ and $N=8$, find $X(K)$ using DIT-FFT algorithm.

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b) For $x(n) = \{1+5j, 2+6j, 3+7j, 4+8j\}$, find DFT $X(K)$.

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Using the result above and not otherwise, find DFT of following sequences:-

- i) $x_1(n) = \{1, 2, 3, 4\}$ and ii) $x_2(n) = \{5, 6, 7, 8\}$.

6. a) Explain the overlap-add and overlap-save method for filtering of long data sequences.

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b) Draw the functional block diagram of TMS320C5X processor and explain various functional units.

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7. a) Using DFT/IDFT, find circular convolution of- $x_1(n) = \{1, 1, 2, 2\}$ and $x_2(n) = \{1, 2, 3, 4\}$.

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b) Classify the following systems as FIR/IIR, Min/Max/Mixed Phase and specify the pass band from the pole-zero plot shown:-

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