T.E sem VI Etrx D.T.S.P 31/5106

Con. 2991-06. (REVISED COURSE) TV - 8475

(3 Hours) [Total Marks : 100

P3/DUP/QILO E-4-28 192

N. B. : (1) Question **one** is **compulsory**.
(2) Attempt in all **five** questions including Question **one**.
(3) Assume **suitable** data if **necessary**.

1. (a) Draw a block diagram of architecture of TMS family DSP and discuss its functions and capabilities. 6
(b) A causal LT1 system has a transfer function $H(z) = H_1(z) \cdot H_2(z)$. 10

and $H_1(z) = \frac{1-0.2z^{-1}}{1+0.5z^{-1}}$, $H_2(z) = \frac{10}{1+0.3z^{-1}}$

(i) What is ROC condition for stable system ?
(ii) Find impulse response.
(iii) Find the system response if $X(z) = \frac{1}{1-0.2z^{-1}}$
(iv) Draw Pole–zero diagram.

(c) Prove that any arbitrary signal can be expressed as the sum of two signals, one of which is EVEN and other is ODD. 4

2. (a) For the following systems, examine they are linear / Nonlinear, Causal / Noncausal, Time varying / Time invariant, Stable / unstable. 16
(i) $y(n) = \cos(x(n))$
(ii) $y(n) = x(2n)$
(iii) $y(n) = x(-n)$
(iv) $y(n) = x(n) \cos(w_o n)$

(b) Prove that $n.x(n) \xleftrightarrow{z} -z\frac{dx(z)}{dz}$ 4

if $x(n) \xleftrightarrow{z} x(z)$

3. (a) Determine and sketch the magnitude and phase response of the following system. 8
$y(n) = 2 \cdot x(n-1) - x(n-2)$
(b) A causal DT system has a difference equation given below. 8
$y(n) = x(n) - 0.4\, y(n-1) - 0.25\, y(n-2)$
What is the ROC of this system ?
(c) Justify the statement that the discrete time sinusoidal signal is not always periodic. 4

... discrete time sinusoidal signal is not always periodic. 4

4. (a) A Second order discrete time system is given by difference equation. 8

$$y(n) - 0.1\, y(n-1) - 0.02\, y(n-2) = 2\, x(n) - x(n-1)$$

Determine y (n) for $n \geq 0$ when x (n) = u (n) and initial conditions are —

$y(-1) = -10$ and $y(-2) = 5$.

(b) Find ROC condition to make the system stable if. 8

$$H(z) = \frac{z^2 - 6z + 8}{(z+3)\,(z+4)(z-0.333)}$$

(c) State and prove shifting theorem of z-transform. 4

5. (a) Calculate the inverse z-transform of the function. 8

$$x(z) = \frac{(z-a)(z-b)}{(z-c)(z-d)}$$

for (i) ROC $|z| < |c|$
(ii) ROC $|c| < |z| < |d|$
(iii) ROC $|z| > |d|$

(b) Draw the direct forms, cascade and parallel forms of the LT1 system given below :— 12

$$H(z) = \frac{(z-a)(z-b)}{(z-c)(z-d)}$$

6. (a) Calculate the DTFT 6

$x(n) = A \cos(W_n + \phi)$

(b) Calculate inverse DTFT of $x(jw) = \exp(-j\phi)$ 6
if $0 < w < \pi$ and $x(jw) = \exp(j\phi)$ if $-\pi < w < 0$.

(c) Calculate the convolution using of z-transform of — 8

$x(n) = a^n$, for $0 \leq n \leq N-1$
$y(n) = b^n$, for $0 \leq n \leq M-1$

7. (a) Given the 8–point DFT of the sequence. 8

$x(n) = 1, \quad 0 \leq n \leq 3$
$= 0, \quad 4 \leq n \leq 7$

using the above DFT compute DFT sequences for—

(i) $x_1(n) = 1, \quad n = 0$
$= 0, \quad 1 \leq n \leq 4$
$= 1, \quad 5 \leq n \leq 7$

(ii) $x_2(n) = 0, \quad 0 \leq n \leq 1$
$= 1, \quad 2 \leq n \leq 5$
$= 0, \quad 6 \leq n \leq 7$

(b) Using 4–point DFT and IDFT determine the circular convolution of — 6

$x_1(n) = \{1, 2, 3, 1\}$
$\uparrow$
$x_2(n) = \{4, 3, 2, 2\}$
$\uparrow$

(c) Draw FFT flow graph for N = 4 and hence find DFT for — 6

$x(n) = \{1, 2, 3, 4\}$