29/5/13

T.E (ETRX) VI Rev.
Discrete Time Signal & System.

59 : 1ST HALF-13 (s)-JP

Con. 9728–13. **GS–1216**

(3 Hours) **[Total Marks : 100**

N.B. (1) Question No. **1** is **compulsory**.
(2) Attempt any **four** questions from remaining questions.
(3) Assume **suitable** data whereever **necessary**.
(4) **Figures** to the **right** indicate **full** marks.

1. (a) Classify the following systems on the basis of linearity and time variance / invariance: **5**
   (i) $y[n] = 4\,x[n] - 2y[n-1]$
   (ii) $y[n] - 2ny[n-1] = x[n]$
   (iii) $y[n] + 2y^2[n] = 2x[n] - x[n-1]$
   (iv) $y[n] - 2y[n-1] = 2^{x[n]}\,x[n]$
   (v) $y[n] = x[-n]$

   (b) Find the number of complex addition and complex multiplication required to find DFT for 16 point signal. Compare them with number of computations required, if FFT algorithm is used. **5**

   (c) Prove that Discrete time harmonics are not always periodic in frequency. **5**

   (d) Compare IIR and FIR. **5**

2. (a) Determine causal, non causal and both sided signal associated with z-transform. **10**

$$x(z) = \frac{1}{1 + 1{\cdot}5\,z^{-1} + 0{\cdot}5\,z^{-2}}.$$

   (b) If $x[n] = \{3, 2, 1, 2\}$, $h[n] = \{1, \underset{\uparrow}{2}, 1, 2\}$ **10**

   Determine linear convolution.

3. (a) Consider a sequence $x[n] = \{1, 2, 1, 2, 0, 2, 1, 2\}$. Determine DFT using DITFFT. **10**

   (b) Find DFT of the sequence $x[n] = \{1, 2, 3, 4\}$ and using this result and not otherwise. **10**
   Find DFT of –
   (i) $x_1[n] = \{1, 0, 2, 0, 3, 0, 4, 0\}$
   (ii) $x_2[n] = \{1, 2, 3, 4, 0, 0, 0, 0\}$
   (iii) $x_3[n] = \{1, 2, 3. 4, 1, 2, 3, 4\}$

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4. (a) The transfer function of discrete time system has poles at $z = \frac{1}{3}$, $z = \pm \frac{j}{2}$, and $z = -2 \pm j$ and zeros at $z = 0$ and $z = -1$. **10**

   (i) Sketch pole-zero diagram

   (ii) Derive the system transfer function

   (iii) Develop difference equation

   (iv) Find if the system is stable.

   (b) Derive the composite radix for $\delta = 2 \cdot 3$ algorithm. Draw the flow chart. **10**

5. (a) Explain Overlap add and overlap save method. **10**

   (b) Determine the steady state response of the system $H(z) = \frac{3z^2}{z^2 - z + 1}$ for the input $x[n] = (0 \cdot 6)^n + 2(0 \cdot 4)^n \cos(0 \cdot 5\, n\, \pi - 100°)$. **10**

6. (a) Show DF-I, DF-II , cascade and parallel realization for $H(z) = \frac{1 - \frac{1}{2} z^{-1}}{1 - z^{-1} + \frac{3}{16} z^{-2}}$. **10**

   (b) Let $H(z) = \frac{z^2}{z^2 - \frac{1}{6} z - \frac{1}{6}}$ let the input $x[n] = 4\, u(n)$ and the initial conditions be **10**

   $y[-1] = 0$, $y[-2] = 12$.

   Find :—

   (i) Zero input response

   (ii) Zero state response

   (iii) Total response.

7. Write short notes (any **four**) :— **20**

   (a) Properties of DTFT

   (b) Geortzel Algorithm

   (c) Mapping between s-plane and z-plane

   (d) Applications of DSP to Biomedical field

   (e) TMS 320C5X series processor.