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EX–703

B. E. (Seventh Semester)
EXAMINATION, Dec., 2011
(Electrical & Electronics Engg. Branch)
DIGITAL SIGNAL PROCESSING
(EX – 703)

Time : Three Hours

Maximum Marks : 100

Minimum Pass Marks : 35

Note : Attempt any *five* questions. Each question having equal marks.

1. (a) Consider two LTI system connected in series. Show that the overall system response does not depend on the order of interconnection. 8

   (b) Find the output $y(n)$ of a causal discrete time LTI system which is characterised by the difference equation : 12

$$y(n) - \frac{3}{4}y(n-1) + \frac{1}{8}y(n-2) = 2x(n)$$

for input :

$$x(n) = \left(\frac{1}{4}\right)^n u(n)$$

2. (a) What are the advantages of Digital Signal Processing over Analog Signal Processing ? 8

   (b) Consider the analogy signal : 12

$$x(t) = 300 \cos 2000\pi t + 5 \sin 6000\pi t + 10 \cos 12000\pi t$$

   What is the discrete-time signal obtained after sampling the above continuous signal using a sampling rate $f(s) = 5000$ samples/second ?

3. (a) Draw the block diagram representation in direct form, cascade form and parallel form for a discrete time LTI system expressed by the following transfer function : 10

$$H(z) = \frac{1}{\left(1 + \frac{1}{3}z^{-1}\right)\left(1 - \frac{1}{6}z^{-1}\right)}$$

   (b) Find the Z-transform of the discrete-time signal : 10

$$x(n) = 3n \cdot u(n-2)$$

4. (a) Determine the DFT of a sequence $x(n) = \{1, 1, 0, 0\}$ and check the validity of your answer by calculating its IDFT. 10

   (b) Determine the N-point DFT of the following non-causal sequences : 10

$$h(n) = \begin{cases} 1/3 & \text{for} -1 \le n \le 1 \\ 0 & \text{for elsewhere} \end{cases}$$

5. (a) Explain Radix-2 DIF-FET algorithm. Compare it with DIT-FET algorithm. 10

   (b) Obtain the 8-point FFT of the following pulse signal using flow diagram : 10

$$x(0) = x(1) = x(2) = x(3) = 1$$

$$x(4) = 0$$

$$x(3) = x(6) = x(7) = 1$$

Use DIF-FFT algorithm

6. (a) Explain in detail Gibbs phenomenon. 6

   (b) Design the band pass linear phase FIR filter having cut off frequencies $\omega_{c1} = 1$ rad/sample and $\omega_{c2} = 2$ rad/sample. Obtain the unit sample response through the following window : 14

$$\omega(n) = \begin{cases} 1 \text{ for } 0 \le n \le 6 \\ 0 \quad \text{otherwise} \end{cases}$$

   Also, obtain the magnitude/frequency response.

7 (a) Compute the steady state variance of the network in the output because of quantization of input for the first order filter : 1(

$$y(n) = a\,y(n-1) + x(n)$$

   (b) Design the digital high pass filter for cut-off frequency of 30 Hz and sampling frequency of 150 Hz using BLT 1(

8. Write short notes on any *three* of the following : 2(

   (a) Properties of Z-transform

   (b) Properties of DFT

   (c) Design specification using Kaiser window function

   (d) Type II frequency sampling method