Reg. No. : | | | | | | | | | | | |

Question Paper Code : R 3736

B.E./B.Tech. DEGREE EXAMINATION, NOVEMBER/DECEMBER 2009.

Fifth Semester

Information Technology

IF 351 — DIGITAL SIGNAL PROCESSING

(Regulation 2001)

Time : Three hours Maximum : 100 marks

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. Define the Amplitude scaling.

2. List the properties of linear convolution.

3. How will you compute IDFT using radix-2 FFT algorithm?

4. Calculate the DFT of the sequence $x(n) = \{1,1,0,0\}$.

5. List the different types of structure for realization of IIR systems.

6. Draw the Direct form-I of second order IIR system with equal number of poles and zeros.

7. What are the desirable characteristics of the frequency response of windows function?

8. Write down the procedure for FIR filter design by frequency sampling method.

9. What are the advantages of DSP?

10. Define music synthesis.

PART B — (5 × 16 = 80 marks)

11. (a) (i) Determine the impulse response sequence of discrete time LTI system defined by

$$y(nT) - 2y(nT - T) + y(nT - 2T) = x(n) + 3x(nT - 3T).$$ (8)

(ii) Obtain and sketch the impulse response of shift invariant system described by

$$y(n) = 0.4x(n) + x(n-1) + 0.6x(n-2) + x(n-3) + 0.4x(n-4).$$ (8)

Or

(b) (i) Determine the z-transform and their ROC of the following discrete sequence

$$x(n) = \{2,4,5,7,3\}$$
$$\uparrow$$ (8)

(ii) Determine the inverse transform of the following function,

$$X(z) = \frac{1}{1 - 1.5z^{-1} + 0.5z^{-1}}.$$ (8)

12. (a) (i) Compute the DFT sequences, $x(n) = \{0,1,2,3\}$. Sketch the magnitude and phase spectrum. (8)

(ii) Compare the DIT and DIF radix-2 FFT. (8)

Or

(b) (i) Compute the DFT of the sequences

$$x(n) = 1, \quad 0 \le n \le 2$$
$$= 2, \quad 2 \le n \le 4$$
$$= 0, \quad \text{otherwise}$$

Sketch the magnitude and phase spectrum. (8)

(ii) Compute an 8-point DFT of $x(n) = \{-1,-1,2,2,-1,-1,2,2\}$ by radix-2 DIT-FFT. (8)

13. (a) For second order IIR filter

$$H(z) = \frac{1}{(1-0.5z^{-1})(1-0.45z^{-1})}$$

Find the effect of shift in pole location with 3-bit co-efficient representation in

(i) Direct form

(ii) Cascade form. (8 + 8)

Or

(b) (i) Add + 0.375 and – 0.625 by using one's and two's complement addition. (8)

(ii) Explain the various formats of fixed point representation. (8)

14. (a) Design a lowpass filter using hanning window with cutoff frequency of 0.9 rad/sec and $N = 6$. (16)

Or

(b) For the following analog transfer function determine $H(z)$ by bilinear transformation by $T = 1$ sec.

(i) $H_a(s) = \frac{(s+2)}{(s+0.5)(s+4)}$. (8)

(ii) $H_a(s) = \frac{(s+2)}{(s^3+2s^2+0.5s+1)}$. (8)

15. (a) (i) Discuss the multirate digital signal processing system in detail. (8)

(ii) Explain the various steps involved in sampling rate conversion process. (8)

Or

(b) (i) Draw and explain the block diagram of subband coding system. (8)

(ii) Discuss about the musical sound processing. (8)