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Question Paper Code : 41206

B.E./B.Tech. DEGREE EXAMINATION, NOVEMBER/DECEMBER 2015.

Fifth Semester

Electronics and Communication Engineering

EC 1302 — DIGITAL SIGNAL PROCESSING

(Regulation 2008)

Time : Three hours Maximum : 100 marks

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. State the condition for BIBO stability.

2. What are the different types of signal representation?

3. Find the z – transform of the sequence $x(n)=\underset{\uparrow}{\{-1, 2, -3, 4, -5\}}$.

4. What is the relationship between z – transform and DT Fourier transform?

5. Determine the circular convolution of the following sequence $x(n)=\{1,-1, 1\}$ and $h(n)=\{1, -2\}$.

6. What is meant by 'in place' computation of FFT?

7. Draw the frequency response of N point Hanning window.

8. Mention any two properties of Butterworth and Chebyshev filters.

9. List the functional blocks present in TMS320C54x.

10. What do you mean by quantization step size?

PART B — (5 × 16 = 80 marks)

11. (a) (i) A LTI system with impulse response $h(n)=u(n)-u(n)-u(n-6)$ is excited by an input $x(n)=[u(n-1)-u(n-5)]$. Determine the output of the system. (8)

(ii) Examine whether the following system are linear, time-invariant, causal and stable or not

(1) $y(n)=x(n/2+2)$

(2) $y(n)=x(n)\cos\omega_0 n$. (8)

Or

(b) (i) Determine the convolution and correlation of the sequence $x(n)=\{1,-1,2,-3,3\}$ and $h(n)=\{0.5,1,1,2,2\}$. (8)

(ii) For the analog signal $x(t)=3\cos 2000\pi t+5\sin 6000\pi t+10\cos 12000\pi t$, find the following (1) Nyquist sampling rate (2) discrete time signal if the analog signal $x(t)$ sampled using $F_s=5000$ samples/sec. (8)

12. (a) (i) Determine the final value of the following Z – transform.

(1) $\dfrac{(2z+1)(z-2)}{z(z-1)}$

(2) $\dfrac{z+1}{2(z^2+1)(z-0.9)}$. (8)

(ii) Find the inverse Z – transform of $X(z)=\dfrac{z}{3z^2-4z+1}$ for the ROC

(1) $|z|<1/3$

(2) $1/3<|Z|<1$. (8)

Or

(b) (i) Determine the magnitude of phase response of the system whose difference equation $y(n)-\frac{1}{4}y(n-1)=x(n)-x(n-1)+2x(n-2)$. (8)

(ii) Determine the stability of the system

$y(n)-1/4\,y(n-1)+1/4\,y(n-2)-1/16\,y(n-3)=2x(n)+3x(n-1)$. (8)

13. (a) (i) State and prove the following properties of DFT

(1) Circular convolution

(2) Parseval's relation. (8)

(ii) Compute the 8 point DFT of the sequence $x(n)=\{0.5, -0.5, 0.5, -0.5, 0, 0, 0, 0\}$ using radix-2 DIF FFT algorithm. (8)

Or

(b) (i) Draw the butterfly diagram of radix-2 DIT FFT algorithm. Assume $N=8$. (8)

(ii) Find the circular convolution of the following two sequences using matrix method and concentric circle method.

$x_1(n)=\{2, 3, -1, 2\}$; $x_2(n)=\{-1, 2, -1, 2\}$. (8)

14. (a) (i) Obtain the direct form II, cascade and parallel realization for the following systems $y(n)=0.1x(n-1)+0.2y(n-2)+3x(n)+3.6x(n-1)-0.6x(n-2)$. (8)

(ii) Discuss the limitation of designing an IIR filter using impulse invariant method. (8)

Or

(b) Determine $H(Z)$ for a Butterworth filter satisfying the following specifications.

$0.6 \le |H(e^{j\omega})| \le 1$, for $0 \le \omega \le \pi/4$

$|H(e^{j\omega})| \le 0.2$, for $\pi/2 \le \omega \le \pi$.

15. (a) Draw the TMS320C54X multiplier and adder functional diagram explain the function of each block.

Or

(b) (i) Discuss the different addressing modes of the TMS320C54X. (8)

(ii) Describe the effects of quantization error in the design of FIR filter. (8)
