Total No. of Questions : 12]

SEAT No. : ____

P4566

[Total No. of Pages : 3

[4958] - 1044
T.E. (E&TC)
DIGITAL SIGNAL PROCESSING
(2012 Pattern)

Time : 2½ Hours] ***[Max. Marks :70***

Instructions to the candidates:

1) ***Neat diagrams must be drawn wherever necessary.***
2) ***Figures to the right indicate full marks.***
3) ***Your answers will be valued as a whole.***
4) ***Use of logarithmic tables slide rule, Mollier charts, electronic pocket calculator and steam tables is allowed.***
5) ***Assume suitable data, if necessary.***

Q1) a) Consider the Analog signal **[4]**

$x_a(t) = 3 \cos 2000\pi t + 5 \sin 6000\pi t + 10 \cos 12000t.$

i) Find the sampling frequency.

ii) What is the discrete time signal obtained after sampling?

b) List the advantages of digital signal processing over analog signal processing. **[3]**

OR

Q2) a) A continuous time sinusoid $x_a(t)$ with fundamental period $T_m = \frac{1}{t_m}$ is sampled at rate $t_s = 1/T$ to produce discrete time signal $x(n) = x_a(nT)$. Show that $x(n)$ is periodic if $T/T_m = K/N$, where K & N are integers. **[4]**

b) Explain the basic elements of a DSP system. **[3]**

Q3) a) Compute the DFT of following sequence using DFT equation (formula), for N = 4 $x(n) = (-1)^n$. **[4]**

b) Discuss the computational requirement of the N-point FFT algorithm. **[3]**

OR

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Q4) a) Perform the circular convolution of two sequences given below. **[4]**

$x_1(n) = \{2, 1, 2, 1\}$

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

b) List any six properties of DFT. **[3]**

Q5) a) What is the need of transform? What is relation between Laplace transform & Z-transform & its mapping. **[3]**

b) Find out the system function H(Z) and difference equation for $y(n)$, if impulse response of a system $h(n) = 2(0.5)^n$. **[3]**

OR

Q6) a) Find the Z-transform & define its ROC for the following signals. **[4]**

i) $x(n) = \delta(n - 3)$

ii) $x(n) = 2^n\, u(n - 2)$

b) Explain conditions in Z domain for a system to be stable and for a causal system to be stable. **[2]**

Q7) a) Design the complete Digital Butterworth filter using BLT for T = 1, for following specifications. **[10]**

$$0.8 \leq |\, H(e^{j\omega}) \,| \leq 1 \qquad 0 \leq \omega \leq 0.2\pi$$

$$|\, H(e^{j\omega}) \,| \leq 0.2 \qquad 0.6\pi \leq \omega \leq \pi$$

b) Explain the impulse invariance technique in detail. What is drawback of it? How Bilinear Transformation removes it? **[8]**

OR

Q8) a) Given the difference equation **[10]**

$y(n) = -0.1y(n - 1) + 0.2\, y(n-2) + 3x(n) + 3.6\, x(n-1) + 0.6\, x(n-2)$.

Obtain the direct form I & II, cascade and parallel realization of the system.

b) Draw & compare the characteristics of Butterworth filter, Chebyshev filters and elliptic filter. **[8]**

Q9) a) Explain FIR filter design using Windowing technique. Compare the different window functions w.r.t. transition band, main lobe, and peak side lobe width. Justify the role of kaiser window in FIR filter design. **[8]**

b) Design an FIR filter with Hamming window for following specification. **[8]**

$$H_d(\omega) = e^{-j3\omega} \qquad -\frac{\pi}{4} \le \omega \le \frac{\pi}{4}$$

$$= 0 \qquad \pi/4 < \omega \le \pi$$

OR

Q10)a) What are the characteristics of FIR filters. Explain frequency sampling technique of FIR filter design. **[8]**

b) Draw & explain the characteristics of ideal filters & its requirements. Why the ideal filters are not realizable. Explain the Gibbs phenomenon & why it occurs? **[8]**

Q11)a) What is the principle of down sampling? What is importance of antialiasing filter? Derive the expression for decimated output signal y(m). **[8]**

b) Draw the functional block diagram of TMS 320C67XX & explain any five salient features of TMS 320C67XX. **[8]**

OR

Q12)a) With the aid of block diagram & waveform explain sampling rate conversion by Non-integer factor. **[8]**

b) Explain following applications of DSP. **[8]**

i) Voice processing.

ii) Image processing.

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