Total No. of Questions : 12]

SEAT No. :

P4014

[Total No. of Pages : 3

[5353]-18
T.E. (Computer)
DIGITAL SIGNAL PROCESSING
(2008 Pattern)

Time : 3 Hours] *[Max. Marks : 100*

Instructions to the candidates:

1) ***Answers to the two sections should be written in separate answer books.***
2) ***Answer any three questions from each section.***
3) ***Neat diagrams must be drawn wherever necessary.***
4) ***Figures to the right side indicate full marks.***
5) ***Use of calculator is allowed.***
6) ***Assume Suitable data if necessary.***

SECTION - I

Q1) a) Impulse response of DT-LTI system is, $h(n) = (0.9)^n + u(n + 2)$ **[6]**

i) Determine the stability of the system

ii) Justify whether the system is causal or noncausal.

b) Determine the output of the LTI system whose input signal and input sample response are given: $x(n) = b^n u(n)$ and $h(n) = a^n u(n)$. **[8]**

c) With example explain static and dynamic DT system. **[4]**

OR

Q2) a) Determine a linear convolution between x(n) and h(n)

$x(n) = u(n) - u(n-3)$ and $h(n) = u(n - 1) - u(n - 5) + u(n - 2) - u(n - 4)$. **[8]**

b) Determine whether the following systems **[10]**

i) $y(n) = x(n^2)$

ii) $y(n) = x^2(n)$

are linear or nonlinear

Q3) a) State and prove periodicity property of Fourier transform (DTFT) and discrete fourier transform (DFT). **[12]**

b) Determine fourier transform of $x(n) = a^n u(n)$ for $-1 < a < 1$. **[4]**

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OR

Q4) a) Explain clearly the circular convolution. **[8]**

b) Obtain 4 point circular convolution using DFT and IDFT x(n) = { 1, 2, – 3, 4} and h(n) ={ 2, 1, 2, 1). **[8]**

Q5) a) Describe an inverse z-transform using partial fraction method. Determine

inverse z- transform of $X(z)=\frac{1-\frac{1}{2}z^{-1}}{1-\frac{1}{2}z^{-2}} \; |z|>\frac{1}{2}$ **[12]**

b) Explain in-place computation in FFT. **[4]**

OR

Q6) a) State and prove convolution property of Z-transform. Determine the convolution of the following pair of signals. **[12]**

$x_1(n)=\left(\frac{1}{4}\right)^n u(n-1)$ and $x_2(n)=\left[1+(1/2)^n\right]u(n)$

b) Explain bit-reversal indexing in FFT. **[4]**

SECTION - II

Q7) a) A causal DT system is described by means of pole zero plot having 2nd order zero at z = 0 and two poles at z = 0.5 and z = 1. Sketch the pole zero plot and thereby obtain the system function and difference equation. Find out the impulse response h(n). **[8]**

b) How to determine the causality and stability from H(z)? Illustrate with one example and obtain the impulse response for the same. **[8]**

OR

Q8) a) Explain how the system function is obtained from the general difference equation. State causality and stability conditions w.r.t. H(z). **[8]**

b) Determine impulse response of a system describe by the difference equation **[8]**

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

Also find magnitude response for the same.

Q9) a) Explain Kaiser window for FIR filter design. **[8]**

b) Design a second order low pass DT Butterworth filter with cutoff frequency of 1 kHz and sampling frequency of 10^4 samples/sec by using BLT. **[10]**

OR

Q10)a) Design a high pass linear phase FIR filter having cutoff frequency w_c and window function of, **[8]**

$$w(n) = \begin{cases} 1, & for\ 0 \le n \le 6 \\ 0, & \text{otherwise} \end{cases}$$

b) What is frequency warping effect in BLT? **[4]**

c) What are the advantages and disadvantages of digital filters over analog filters. **[6]**

Q11)a) What are the advantages of Direct form-II structure over Direct form-I? **[6]**

b) Explain linear phase FIR filter structure and realize the following system function for the same. **[10]**

$$H(z) = 1 + \frac{2}{3}z + \frac{2}{3}z^{-1}.$$

OR

Q12)a) Explain different internal buses present in ADSP 21xx family. **[8]**

b) Realize the following system function in cascade form of FIR filter. **[8]**

$$H(z) = 1 + \frac{2}{4}z^{-1} + \frac{17}{8}z^{-2} + \frac{3}{4}z^{-3} + z^{-4}.$$

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