Total No. of Questions : 12]

SEAT No. :

P1666

[Total No. of Pages : 4

[5058]-154
T.E. (Computer)
DIGITAL SIGNAL PROCESSING
(2008 Course) (Semester - I)

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) Define and calculate nyquist rate for an analog signal, **[6]**

$x_a(t) = 3\cos 50\pi t + 10 \sin 300 \pi t - \cos 100\pi t$.

b) Define linear convolution. Explain different properties of convolution with example. **[10]**

OR

Q2) a) Obtain a linear convolution of DT signal **[8]**

$x(n) = h(n) = \{\underset{\uparrow}{1}, 2, -1\}$.

b) State static, dynamic system properties of a DT system and test it for

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

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

[8]

Q3) a) Find the Fourier transform of the following: **[8]**

i) $\partial(n-1)+\partial(n+1)$

ii) $\partial(n+2)-\partial(n-2)$

b) Compare DFT with DTFT. State and prove linearity property of DFT. **[8]**

OR

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Q4) a) Obtain 2-point and 4-point DFT for a sequence $x(n)=2\,\partial(n)-\frac{3}{2}\partial(n-1)$. **[8]**

b) Obtain DTFT of left handed exponential signal $x(n)=a^{-n}u(-n-1)$. **[8]**

Q5) a) Define ROC of Z transform. State significance of ROC. Derive the relationship between Z transform and fourier transform. **[8]**

b) Compare DIF FFT algorithm with DIT FFT algorithm. Draw basic butterfly structure for both. **[10]**

OR

Q6) a) Obtain the inverse z transform using residue method where

$$X(z)=\frac{1}{(z-1)(z-3)}.$$ **[8]**

b) Determine the Z-transform of the following: **[10]**

i) $x(n)=n(-1)^n u(n)$

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

SECTION - II

Q7) a) Find the difference equation satisfying the input and output of an LTI system. **[8]**

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

b) Determine impulse response of a system:

$$y(n)=-3y(n-1)-2y(n-2)+2x(n)+x(n-1)$$ **[8]**

OR

Q8) a) Explain the method of simple geometric interpretation to obtain the frequency response of DT system. **[8]**

b) Determine H(z) and draw a pole zero plot for a system. **[8]**

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

Q9) a) Explain Gibb's phenomenon associated with FIR filter design. What are the desirable features of window function to improve the frequency response? **[10]**

b) Explain the design steps of FIR filter using rectangular window. State the advantages of windowing method. **[8]**

OR

Q10)a) What are the different methods to design IIR filters? How stable analog filter is converted into stable digital filter? Explain the concept of frequency warping and prewarping? **[10]**

b) Design the digital IIR filter with a 3 dB bandwidth of 0.2π by using BLT method. The transfer function of $H(s)=\frac{\Omega c}{s+\Omega}$ where Ω_c is the 3 dB bandwidth of analog filter. **[8]**

Q11)a) Explain the cascade form structure of FIR filter and realize the following system function for the same. **[10]**

$$H(z)=\left(1+\frac{1}{2}z^{-1}+z^{-2}\right)\left(1+\frac{1}{4}z^{-1}+z^{-2}\right).$$

b) Compare DSP processor and general purpose processors. **[6]**

OR

Q12)a) The transfer function of discrete time causal system is given by **[10]**

$$H(z)=\frac{1-z^{-1}}{\left(1-0.5z^{-1}\right)\left(1+0.3z^{-1}\right)}$$

Draw cascade and parallel realization of IIR filter.

b) Draw a direct form - I IIR filter structure for: **[6]**

$$H(z)=3+\frac{4z}{(z-0.5)}-\frac{2}{(z-0.25)}.$$