Total No. of Questions : 10]

SEAT No. :

P2981

[Total No. of Pages : 3

[5058]-364
T.E. (E & TC)
DIGITAL SIGNAL PROCESSING
(2012 Pattern) (End Sem.) (Semester - I) (304182)

Time : 2½ Hours] *[Max. Marks : 70*

Instructions to the candidates:

1) ***Answer Q1 or Q2, Q3 or Q4, Q5 or Q6, Q7 or Q8, Q9 or Q10.***
2) ***Neat diagrams must be drawn wherever necessary.***
3) ***Figures to the right indicate full marks.***
4) ***Assume Suitable data, if necessary.***

Q1) a) With the help of neat diagram explain the basic elements of DSP. **[4]**

b) Consider the analog signal $X_a(t) = 3 \cos 2000 \Pi t + 5 \sin 6000 \Pi t + 10 \cos 8000 \Pi t$. **[4]**

i) What is the Nyquist rate for this signal?

ii) If Sampling rate $F_s = 6000$ samples/s. What is the discrete - time signal obtained after sampling?

c) State and prove any two properties of DFT. **[2]**

OR

Q2) a) Compute 8 point DFT of a sequence x(n) = {1 2 3 4 4 3 2 1} using Decimation In Time FFT algorithm. **[8]**

b) Explain the concept of orthogonality. **[2]**

Q3) a) What is the relationship between Z transform and DFT. **[3]**

b) Compute the DFT of the following sequence **[4]**

x(n) = {0 1 2 3}

c) By using partial fraction method find the Inverse Z transform of **[3]**

$$X(z) = \frac{z^3}{(z+1)\,(z-1)}$$

OR

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Q4) a) Show that the computational complexity is reduced if 32 point DFT is computed using Radix - 2 DIT FFT algorithm. **[3]**

b) Compute the z transform and draw ROC of the following sequences. **[3]**

i) $x(n) = n\,u(n)$ for $n \geq 0$

ii) $x(n) = 2^{(n-1)}\,u(n-1)$

c) Compute the Discrete Cosine Transform of the following sequence **[4]**

$f(x) = \{1\ 2\ 4\ 7\}$

Q5) a) The system transfer function of analog filter is given by **[8]**

$$H(S) = \frac{s+0.1}{(s+0.1)^2 + 16}$$

using bilinear transformation method, determine the transfer function of digital filter H(z) the resonant frequency is $w_r = \frac{\pi}{2}$.

b) Explain the steps used for designing an IIR filter using bilinear transformation method (BLT). What is Warping effect in BLT? **[8]**

c) What are the limitations of Impulse invariance method? **[2]**

OR

Q6) a) Obtain direct form I and II realization of a system described by **[8]**

$$y(n) - 3/4\ y(n-1) - 1/2\ y(n-2) + 1/8\ y(n-3) = x(n) + 5/4\ x(n-2).$$

b) A digital filter has specifications as:

Passband frequency = $w_p = 0.2\Pi$, Stopband frequency = $w_s = 0.3\Pi$

What the corresponding specifications are for pass band and stop frequencies in analog domain if **[6]**

i) Impulse Invariance Technique is used for designing

ii) Bilinear Transformation Method is used for designing.

c) Write a note on, "finite word length effect in IIR filter design". **[4]**

Q7) a) Compare FIR filter with IIR filter. **[6]**

b) Design FIR digital filter to approximate an ideal low pass filter with passband gain of unity, cut off frequency 850 Hz and sampling frequency 5000 Hz. The length of impulse response should be 5. Use Hamming window. **[10]**

OR

Q8) a) Explain the Gibb's Phenomenon. **[6]**

b) Design a linear phase FIR low pass filter using Hanning Window the frequency characteristics of the filter is given as **[10]**

$$\mathrm{H}d(w) = e^{-j3w} \quad \text{For} -\frac{\pi}{4} \le w \le \frac{\pi}{4}$$

$$= 0 \qquad \text{otherwise}$$

Q9) a) Design a two stage decimator for the following specifications: **[10]**

Sampling rate of an input signal = 20 kHz

Down sampler D = 100

Passband = 0 to 40 Hz

Transition band = 40 to 50 Hz

Passband ripple = 0.02

Stopband ripple = 0.002

b) Explain the application of DSP in Image processing. **[6]**

OR

Q10)a) Draw the architectural block diagram and explain the important features of TMS 320C 67XX series DSP processor. **[8]**

b) Explain the necessity of: **[8]**

i) MAC unit

ii) Data Address Generators in Digital Signal Processors.