[Total No. of Questions - 9] [Total No. of Printed Pages - 4]
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B. Tech 8th Semester Examination

Digital Signal Processing (NS)

EE-424

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

The candidates shall limit their answers precisely within the answer-book (40 pages) issued to them and no supplementary/continuation sheet will be issued.

Note : Attempt five questions in all, selecting one question each from section A, B, C & D. Section-E is compulsory.

SECTION - A

1. (a) Check whether the following systems are linear or non-linear, Causal or non-causal and Time invariant or time-variant.

(i) $y(n) = a^n u(n)$ (ii) $y(n)=\log_{10}|x(n)|$ (12)

(b) Determine whether the following signals are periodic or not? If periodic determine the fundamental period.

(i) $\sin(10t + 1)-2\cos(5t-2)$ (ii) $\cos\left(\frac{n}{6}\right)\cos\left(\frac{n\pi}{6}\right)$ (8)

2. (a) Determine the z -transform of $\sin\left(\frac{2\pi n}{8}\right)u[n]$. Use properties of z-transform to find z- transform $x_m[n]=\left\{e^{\frac{-n}{40}}\sin\left(\frac{2\pi n}{8}\right)u[n]\right\}$. (12)

(b) Determine the impulse response for the cascade of two linear time-invariant systems having impulse responses

$h_1(n)=\left(\frac{1}{2}\right)^n u(n)$ and $h_2(n)=\left(\frac{1}{4}\right)^n u(n)$ (8)

SECTION - B

3. (a) Consider the two sequences

$x_1(n)=\cos\left(\frac{2\pi}{N}n\right)$, $x_2(n)=\sin\left(\frac{2\pi}{N}n\right)$

Find the N-point circular convolution of $x_1(n)$ and $x_2(n)$. (12)

(b) Discuss overlap-save and overlap-add methods. (8)

4. (a) Consider the sequence $x[n]=\delta[n]+2\delta[n-2]+\delta[n-3]$

(i) Find the four point DFT of x[n].

(ii) If y[n] is the four point circular convolution of x[n] with itself, find y[n] and the four point DFT Y[k]. (10)

(b) Discuss decimation-in-frequency radix-2 FFT algorithm. (10)

SECTION - C

5. (a) Explain the Frequency sampling method of FIR filter design. (10)

(b) Design a FIR filter to meet the following specifications

(i) Pass-band edge: F_p = 2KHz

(ii) Stop-band edge: F_s = 5KHz

(iii) Pass band attenuation A_p = 2dB

(iv) Stop band attenuation A_s = 42dB

(v) Sampling Frequency: F_t = 20KHz (10)

[P.T.O.]

6. (a) For the analog transfer function, $H(s)=\frac{2}{s^2+3s+2}$, determine H(z) using bilinear transformation if (a)T=1 second and (b)T=0.1 second. (12)

   (b) Discuss the various methods of IIR filter design. (8)

SECTION - D

7. (a) Obtain Haar transformation matrix for N=8, where N is the order of matrix. (10)

   (b) Discuss one practical application of wavelets. (10)

8. (a) Explain the various addressing modes used in DSP processors. (12)

   (b) Explain the MAC unit and barrel shifters of DSP processors. (8)

SECTION - E

9. (a) State initial and final value theorem for z-transform.

   (b) What is the causality and stability conditions for LTI system in terms of impulse response of system?

   (c) List the properties of convolution.

   (d) Compare FIR and IIR filters.

   (e) What are the factors that influence the choice of structure for the realization of LTI system?

   (f) What is FFT and why is it needed?

   (g) What is aliasing problem in impulse invariance method of designing digital filters?

   (h) What do you understand by linear phase response?

   (i) What is short time Fourier transform?

   (j)) What is difference between Von Neumann and Harvard architecture? (2×10=20)