Total No. of Questions : 10]

SEAT No. :

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[5460]-152
T.E. (E & TC)
DIGITAL SIGNAL PROCESSING
(2012 Course) (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 example explain the concept of basis function and orthogonality. **[4]**

b) Show the mapping between analog frequencies to digital frequencies. **[3]**

c) What are the advantages of Digital singal processing over Analog singal processing. **[3]**

OR

Q2) a) State and prove any two properties of Z transform. **[4]**

b) Given x(n) = {0, 1, 2, 3, 4, 5, 6, 7} and N=8, find X(K) using Decimation in Time Fast Fourier Transform (DITFFT). **[6]**

Q3) a) State and prove following properties of Discrete Fourier Transform **[4]**

i) Linearity

ii) Circular convolution

b) First five points of 8 point DFT of a real valued sequence are

{28, -4+j9.656, -4+4j, -4+j1.656, -4, ______, ______, ______}. **[3]**

c) Find the Inverse Z transform of

$$X(z) = \frac{Z^3}{(z+1)\,(z-1)^2}$$ **[3]**

OR

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Q4) a) State and prove the relationship between Z transform and Laplace transform. **[3]**

b) Find the Z transform and draw ROC of the following sequences **[3]**

1) $x(n) = coswn \quad for\ n \geq 0$

2) $x(n) = 2^{(n)}u(n)$

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

f(x)= {1 2 5 7}

Q5) a) The system transfer function of an analog filter is given by **[6]**

$$H(s) = \frac{s+0.2}{(s+0.2)^2+9}$$

using bilinear transformation method, determine the transfer function of digital filter. T-1s

b) What are the advantages of BLT over Impulse Invariant Method? Explain the steps used for designing an IIR filter using Impulse Invariant Method (BLT). **[6]**

c) Draw and explain the characteristics of Butterworth Filters, Elliptic filter and Chebyshev filters. **[6]**

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 specification as:

Passband frequency = w_p = 0.4Π, Stopband frequency = w_s = 0.6Π.

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) What are the advantages of FIR filter over IIR filters? Compare Frequency domain Characteristics of Hamming, Hanning, Bartlett and Rectangular windows. **[8]**

b) Design FIR digital filter to approximate an ideal low pass filter with passband gain of unity, cut off frequency 850HZ and sampling frequency 5000 HZ. The length of impulse response should be 5. Use rectangular window. **[8]**

OR

Q8) a) Justify FIR filters are linear phase filters. **[6]**

b) A low pass filter is to be designed the following desired frequency response. **[10]**

$$H_d(e^{jw}) = e^{-j3w} \quad \text{For} \quad -\frac{3\pi}{4} \le w \le \frac{3\pi}{4}$$

$$= 0 \qquad \frac{3\pi}{4} \le w \le \pi$$

Determine $H(e^{jw})$ for m = 7 using Hamming window.

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

Sampling rate of an input signal = 20 KHZ

Down sampler M = 100

Passband = 0 to 40 Hz

Transition band = 40 to 50 HZ

Passband ripple = 0.01

Stopband ripple = 0.002

b) Explain the application of DSP to image and Radar processing. **[6]**

OR

Q10) a) What are the characteristics of TMS 320 processor family? Draw and explain the architectural block diagram TMS 320C 67XX series DSP processor **[8]**

b) Write short note on. **[8]**

i) Sampling rate conversion by a non-integer factor.

ii) MAC and Barrel Shifter in digital Signal Processors.

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