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B.TECH.

THEORY EXAMINATION (SEM-VI) 2016-17

DIGITAL SIGNAL PROCESSING

Time : 3 Hours

Note: Be precise in your answer. In case of numerical problem assume data wherever not provided.

SECTION – A

1. Explain the following:

- (a) What do you understand by Discrete- time systems?
- (b) Test whether the following signal is periodic or not and if periodic then find period of signal: $X[n] = \cos(n\pi/5) + \sin(n\pi/6)$
- (c) What is Nyquist sampling theorem? How reconstruction of signal is done?
- (d) Discuss discrete time processing of continuous time signal and continuous time processing of discrete time signal.
- (e) What is all pass system? Draw its typical pole-zero plot?
- (f) What do you understand by multirate signal processing?
- (g) How sampling & Reconstruction of Discrete Time signal is done?
- (h) Explain Twiddle factor.
- (i) Discuss the relationship of DFT with Z-transform
- (j) Discuss 8-point Radix-2 decimation-in-time FFT algorithms.

SECTION – B

2. Attempt any five of the following questions:

(a) Compute 8-point DFT of the sequence using radix-2 decimation-in-frequency algorithm:

X (n) = {1/2, 1/2, 1/2, 1/2, 0, 0, 0, 0}

(b) Determine the Z-transform W (z) of the Hanning window

$$w(n) = \frac{1 - \cos\left(\frac{2\pi n}{N-1}\right)}{2}$$

What is the effect of finite Register Length?

(c) Consider a causal IIR system with the system function

$$H(z) = \frac{1 + 2z^{-1} + 3z^{-1} + 2z^{-3}}{1 + 0.9z^{-1} - 0.8z^{-2} + 0.5z^{-3}}$$

Determine the equivalent lattice-ladder structure.

(d) Find the transposed direct form II realization of the system described by the difference equation.

$$y(n) = 0.5y(n-1) - 0.25y(n-2) + x(n) - 2x(n-1) + x(n-2)$$

(e) The desired response of a low pass filter is

$$\begin{split} H_d(e^{jw}) &= e^{-j3w}; \quad -\pi \ /4 \leq w \leq \pi \ /4 \\ &= 0 \quad ;\pi \ /4 < IwI < \pi \end{split}$$

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

(f) Convert following analog filters into digital filters. $H(s) = (s+0.1)/((s+0.1)^2+9)$ using bilinear transformation. The digital filter should have a resonant frequency of $w_r = \pi/4$

 $5 \ge 10 = 50$

 $10 \ge 2 = 20$

Max. Marks : 100



FirstRanker.com Transformation method. Also establish relationship between frequencies in two domains.

- **(h)** How IIR filter Designing can be done by the use of following methods. Discuss each methods-
 - Approximation of Derivatives Method. (i)
 - Impulse Invariance Method. (ii)
 - (iii) Bilinear Transformation Method.

SECTION – C

Attempt any two of the following questions:

 $2 \ge 15 = 30$

3 Determine the cascade and parallel realizations for the system described by the system function

$$H(z) = \frac{10\left(1 - \frac{1}{2}z^{-1}\right)\left(1 - \frac{2}{3}z^{-1}\right)\left(1 + 2z^{-1}\right)}{\left(1 - \frac{3}{4}z^{-1}\right)\left(1 - \frac{1}{8}z^{-1}\right)\left(1 - \left(\frac{1}{2} + j\frac{1}{2}\right)z^{-1}\right)\left(1 - \left(\frac{1}{2} - j\frac{1}{2}\right)z^{-1}\right)}$$

- 4 Develop cascade & parallel realization structure of following transfer function: $H(z) = {z/6+5/24+5/24z+1/24z^2}/{1-1/2z+1/4z^2}$
- A low pass filter is to be designed with following desired frequency response 5

$$H_{d}(e^{jw}) = e^{-j^{2w}}, \qquad \pi/4 \le w \le \pi/4 = 0, \qquad \pi/4 < IwI < \pi$$

Determine the filter coefficient $h_d[n]$ if the window function is defined as W[n] = 1; $0 \le n \le 4$

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