Printed Pages : 2 Roll No. EEC602

B.TECH.

THEORY EXAMINATION (SEM–VI) 2016-17

DIGITAL SIGNAL PROCESSING

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

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

SECTION – A

1. Explain the following: **10 x 2 = 20**

(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 (nπ/5) +sin (nπ/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: **5 x 10 = 50**

(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

$H_d(e^{jw}) = e^{-j3w}$; $-\pi/4 \le w \le \pi/4$

$= 0$; $\pi/4 < |w| < \pi$

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 $w_r = \pi/4$

(g) Drive conversion formula of digital filter from Analog filter by using Bilinear 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-

(i) Approximation of Derivatives Method.

(ii) Impulse Invariance Method.

(iii) Bilinear Transformation Method.

SECTION – C

Attempt any two of the following questions: **2 x 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:
$H(z)=\{z/6+5/24+5/24z+1/24z^2\}/\{1-1/2z+1/4z^2\}$

5 A low pass filter is to be designed with following desired frequency response

$$H_d(e^{jw}) = e^{-j2w}, \quad \pi/4 \le w \le \pi/4$$
$$= 0, \quad \pi/4 < |w| < \pi$$

Determine the filter coefficient $h_d[n]$ if the window function is defined as

$W[n] = 1; \quad 0 \le n \le 4$

$= 0; \quad$ Otherwise