PVP 14

Code: EC5T6

III B.Tech - I Semester–Regular Examinations December 2016

DIGITAL SIGNAL PROCESSING
(ELECTRONICS AND COMMUNICATION ENGINEERING)

Duration: 3 hours Max. Marks: 70

PART – A

Answer ***all*** the questions. All questions carry equal marks

11x 2 = 22 M

1.

a) How would you classify the Discrete-Time Systems?
b) State and Prove Differentiation in the z-domain property of z-transform.
c) Determine Even and Odd component of a unit-Step sequence.
d) Establish the relation of the DFT to the Fourier Series Coefficients of a periodic sequence.
e) Obtain Symmetry properties of the DFT for Real-valued sequences.
f) Compare Impulse Invariant and Bilinear transformation techniques.
g) List out the advantages and Limitations of IIR filter design using Impulse Invariant transformation.
h) Can you make a distinction between IIR and FIR Filters?
i) Draw the shapes of several window functions.
j) Define Decimation and Interpolation.

k) What are the advantages of Sampling rate conversion?

PART – B

Answer any ***THREE*** questions. All questions carry equal marks.

3 x 16 = 48 M

2. a) Compute the convolution *y (n) of* the signals

$$x[n] = \begin{cases} \alpha^n, & -3 \le n \le 5 \\ 0, & elsewhere \end{cases}$$

$$h[n] = \begin{cases} 1, & 0 \le n \le 4 \\ 0, & elsewhere \end{cases}$$ 8 M

b) Determine all possible signals *x(n)* associated with the z-transform

$$X[z] = \frac{5z^{-1}}{(1-2z^{-1})(3-z^{-1})}$$ 5 M

c) Prove the final value theorem for the one-sided z-transform. 3 M

3. a) Evaluate the eight-point DFT of the sequence x[n] by using the decimation-in-frequency FFT algorithm. 8 M

$$x[n] = \begin{cases} 1, & 0 \le n \le 7 \\ 0, & otherwise \end{cases}$$

b) Derive the radix-2 decimation-in-time FFT algorithm. 8 M

4. a) Convert the analog filter with system function $H_a(s)$ into a digital IIR filter by means of the bilinear transformation.

The digital filter is to have a resonant frequency of $w_r = {}^{\pi}/_{2}$. 8 M

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

b) Find the order and the poles of a Lowpass Butterworth filter that has a -3-dB bandwidth of 500 Hz and an attenuation of 40 dB at 1000 Hz. 8 M

5. a) Design an FIR Digital Low-Pass Filter using Rectangular window whose cut-off frequency is 2 rad/s and length of window N=9. 8 M

b) Obtain the IIR direct form II and cascade-form realizations for the system.

$$y[n] = -\frac{3}{8}y[n-1] + \frac{3}{32}y[n-2] + \frac{1}{64}y[n-3] + 3\,x[n-1] + 2\,x[n-2]$$

8 M

6. a) For the sequence $x[n] = \{5,6,1,4,2,1,3,12,10,7,11\}$find the output sequence y(n) which is down sampled version of x[n] by 2? 8 M

b) Can you formulate a theory for Multistage implementation of interpolation by a factor I and factor D? 8 M