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7E4045

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B. Tech. (Sem. VII) (Main/Back) Examination, December-2012

Electronics & Comm.

7EC2 Digital Signal Processing (Common for 7EC2, 7AI2, 7EI2, 7EX6.1)

Time : 3 Hours] [Maximum Marks : 80

[Min. Passing Marks : 24

Attempt any Five questions selecting one question from each unit. All questions carry equal marks. Schematic diagrams must be shown wherever necessary. Any data you feel missing suitably be assumed and stated clearly. Units of quantities used/calculated must be stated clearly.

Use of following supporting material is permitted during examination. *(Mentioned in form No. 205)*

1. NIL 2. NIL

UNIT - I

1 (a) What is discrete time processing of continuous time signals ? 8

(b) The continuous time signal

$x_c(t) = \cos(9000\pi t)$

is sampled with T to obtain discrete time signal.

$x(n) = \cos\left(\frac{\pi n}{3}\right)$

(i) Determine choice for T consistant with this information. 4

(ii) Is your choice for T in part (i) is unique ? If so explain why ? If not then specify another. 4

OR

1 (a) Explain decimators and interpolator with suitable block diagram and derivation. 8

(b) How can we reconstruct the band limited signal from its samples ? 8

UNIT - II

2 (a) Find the impulse response, frequency response, magnitude response and phase response of second order system.

$$y(n)-y(n-1)+\frac{3}{16}y(n-2)=x(n)-\frac{1}{2}x(n-1)$$

8

(b) Check whether the system described by the following equations

(i) $y(n)=3x(n-2)+3x(n+2)$

(ii) $y(n)=x(n-1)+9x(n-2)$

are (i) causal (ii) stable (iii) linear

8

OR

2 (a) A discrete time causal LTI system function

$$H(z)=\frac{\left(1+0.2^{Z-1}\right)\left(1-9Z^{-2}\right)}{\left(1+0.81Z^{-2}\right)}$$

(i) is the system stable

(ii) Find expression for minimum phase system $H_1(z)$ and all pass system $Hap\ (z)$ such that
$H(z) = H_1(z) - Hap\ (z)$

10

(b) The input and output if the system are given by

$$x(n)=\left(\frac{1}{2}\right)^n U(n)$$

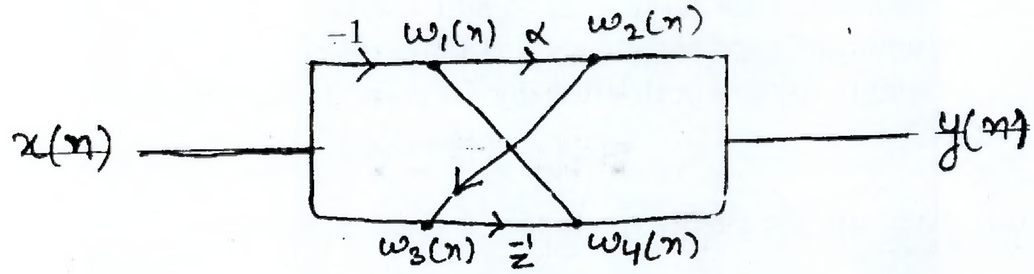
$$y(n)=\left(\frac{1}{2}\right)^n U(n)+2\left(\frac{1}{3}\right)^n U(n)$$

determine the LCCD equations.

6

UNIT - III

3 (a) A linear time invariant system is described by signal flow graph. Find



(i) Direct form I and II structure. **6**

(ii) Impulse response of system **2**

(b) Obtain the parallel form structure for following difference equation

$$y(n)-\frac{5}{6}y(n-1)+\frac{3}{8}y(n-2)-\frac{1}{24}y(n-3)=x(n)+2x(n-1)$$

8

OR

3 (a) Obtain the ladder structure for the IIR filter described by the system function

$$H(z)=\frac{2+8z^{-1}+6z^{-2}}{1+8z^{-1}+12z^{-2}}$$

8

(b) Obtain the structure for FIR filter characterized by

$h(n)=\{1\ 2\ 3\ 4\ 3\ 2\ 1\}$

(i) Direct form structure **4**

(ii) Symmetric linear phase direct form. **4**

UNIT - IV

4 (a) Derive the expression for bilinear transformation and prove

$$W=2\tan^{-1}\left(\frac{\Omega T}{2}\right)$$

6

(b) For the Butterworth low pass filter the specifications are as follows :

Passband attenuation $\alpha_p = -3dB$

Stopband attenuation $\alpha_S = -10dB$

Passband edge frequency = 800 rad/sec.
Stopband edge frequency = 1800 rad/sec.
Design Butterworth filter by Bilinear transformation.

10

OR

4 (a) Explain the design methods for Keiser window.

6

(b) Design an FIR filter with the following specifications :
Passband gain = 1
Cut off frequency = 800 Hz
Sampling frequency = 10 KHz
Length of impulse response = 5
use rectangular window function.

10

UNIT - V

5 (a) Derive the expression for the DIT-FFT.

6

(b) Compute the 8-point DFT for sequence $x(n)=2^n$ using DIT-FFT algorithm.

10

OR

5 (a) Compute the DFT of the data sequence
x(n) = {1, 1, 2, 2, 3, 3} also compute the corresponding amplitude and phase spectrum.

8

(b) Compute the linear convolution using DFT.

$$x(n)=\begin{cases}1; & n=0\\ 1/2; & n=1\\ 0; & \text{otherwise}\end{cases} \qquad h(n)=\begin{cases}1/2; & n=0\\ 1; & n=1\\ 0; & \text{otherwise}\end{cases}$$

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