B.E. (Electronics Engineering / Electronics & Telecommunication / Electronics & Communication Engineering) Sixth Semester (C.B.S.)

P. Pages : 2

Digital Signal Processing

Time : Three Hours

* 0 3 5 2 *

TKN/KS/16/7468/7473

Max. Marks : 80

Notes :
1. All questions carry equal marks as indicated.
2. Solve Question 1 OR Questions No. 2.
3. Solve Question 3 OR Questions No. 4.
4. Solve Question 5 OR Questions No. 6.
5. Solve Question 7 OR Questions No. 8.
6. Solve Question 9 OR Questions No. 10.
7. Solve Question 11 OR Questions No. 12
8. Assume suitable data whenever necessary.
9. Illustrate your answers whenever necessary with the help of neat sketches.
10. Use of non programmable calculator is permitted.

1. a) Explain different types of discrete system with one example. **6**

b) Consider the analog system **8**

$x_a(t) = 3\cos 100\pi t$

i) Determine the minimum sampling rate required to avoid the aliasing.

ii) Suppose that the signal is sampled at the rate fs=200Hz. What is the discrete time signal obtained after sampling.

iii) What is the frequency $O < F < fs/2$ of the sinusoidal that yields samples identical to those obtained in port (ii).

OR

2. a) Show that the necessary and sufficient conditions for stability of LTI system is **5**

$$\sum_{n=-\infty}^{+\infty} |h(n)| < \infty$$

b) The impulse response of a linear time invariant system is $h(n)=\{1, \underset{\uparrow}{2}, 1, -1\}$ Determine the response of the system to the input signal $x(n)=\{\underset{\uparrow}{1}, 2, 3, 1\}$ by using graphical method. **9**

3. a) State and prove any two properties of z-transform. **6**

b) Determine the z-transform of the signal **7**

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

Also sketch the region of convergence (ROC).

OR

4. a) Find the inverse z-transform of the following using Long division method when x(n) is causal and when x(n) is anticausal **6**

$$x(z)=\frac{1+2z^{-1}}{1-2z^{-1}+z^2}$$

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b) Determine the unit response of the system whose difference equation is $y(n) - 0.7\,y(n-1) + 0.12\,y(n-2) = x(n-1) + x(n-2)$ if $y(-1)=y(-2)=1$. 7

5. Find 8 point DFT of the following sequence using decimation in frequency (DIF) – FFT algorithm 14

$x(n) = (-1)^n,\ 0 \le n \le 7$

Also compute the number of complex addition and multiplication required.

OR

6. Determine the sequence $x_3(n)$ corresponding to the circular convolution of the sequence $x_1(n)$ and $x_2(n)$ where $x_1(n) = \{\underset{\uparrow}{2}, 1, 2, 1\}$ and $x_2(n) = \{\underset{\uparrow}{1}, 2, 3, 4\}$ using DFT and IDFT method. 14

7. Obtain direct form-I (DF-I), Direct form-II (DF-II), cascade and parallel form realization for the system $y(n) = -0.1\,y(n-1) + 0.2\,y(n-2) + 3x(n) + 3.6\,x(n-1) + 0.6\,x(n-2)$. 13

OR

8. Design digital Butterworth filter that satisfies the following constraints using Bilinear transformation Assume T = 1 sec. 13

$0.707 \le |H(w)| \le 1$ .....$0 \le w \le 0.2\pi$

$|H(w)| \le 0.2$ $\quad 0.6 \le w \le \pi$

9. Design ideal Low pass filter with frequency response. 13

$$Hd\left(e^{jw}\right) = 1 \text{.....for} -\pi/2 \le |w| \le \pi/2$$

$$= 0 \text{.....for} \pi/2 \le |w| \le \pi.$$

Find the value of h(n) for N=11. Find H(z). Plot the magnitude response.

OR

10. Determine the coefficient of linear phase FIR filter of length M=15 which has symmetric unit sample response and frequency response that satisfies the conditions. 13

$$HR\left(\frac{2\pi k}{15}\right) = \begin{cases} 1 \text{.....} K = 0, 1, 2, 3 \\ 0.4 \text{.....} K = 4 \\ 0 \text{.....} K = 5, 6, 7 \end{cases}$$

11. a) Explain the sampling rate conversion by non-integer factor with the help of block diagram. 6

b) Given the sequence x(n) 7

$x(n) = \{1, 2, 3, 4, 5, 6, 7, 8, 9\}$

Find the output sequence $y_1(n)$ and $y_2(n)$ for the multirate structure shown in fig. Q. 11(b)

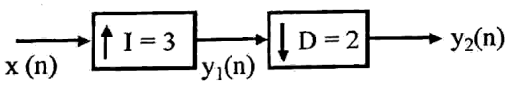

Fig. Q.11 (b)

OR

12. a) What is multirate signal processing? Explain its applications. 6

b) Explain sub band coding of speech signals with the help of block diagram. 7

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