B.E. Seventh Semester (Computer Technology) (C.B.S.)

Elective - I : Digital Signal Processing

P. Pages : 2 **NKT/KS/17/7482**

Time : Three Hours * 0 1 3 3 * Max. Marks : 80

Notes : 1. All questions carry 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. Due credit will be given to neatness and adequate dimensions.
9. Assume suitable data whenever necessary.

1. a) Determine whether the system given below are static or dynamic & linear or non-liner. **8**

i) $y(n) = x(n^2)$ ii) $y(n) = x(n)\cos w_o n$

iii) $y(n) = e^{x(n)}$ iv) $y(n) = n \cdot x(n)$

b) Determine auto correlation of sequence **6**

$x(n) = \{-3, -2, 1, \underset{\uparrow}{4}, 8, -3\}$

OR

2. a) Compute the response y(n) of the system using graphical or analytical method for given **7**

$x(n) = \{-2, \underset{\uparrow}{1}, -1, 0, -3\}$ &

$h(n) = \{1, \underset{\uparrow}{2}, -1\}$

b) State and explain sampling theorem along with mathematical derivation & sketches the frequency spectra. **7**

3. a) Determine the Z-Transform of the following sequences: **6**

i) $x(n) = \left(\frac{1}{3}\right)^n U(-n)$ ii) $x(n) = 3^n U(n-2)$

b) Determine the inverse Z-Transform of the following x(z) by the partial fraction expansion method **7**

$$x(z) = \frac{z+2}{2z^2 - 7z + 3}$$

if the ROCs are :

a) $|z| < 3$ b) $|z| > 1/2$ c) $1/2 < |z| < 3$

OR

4. Determine the Z-Transform of the following. **13**

i) $x(n) = \{3, 1, 2, \underset{\uparrow}{5}, 7, 0, 1\}$ ii) $x(n) = \{2, 4, \underset{\uparrow}{6}, 8, 9, 0\}$

iii) $\delta(n)$ iv) $\delta(n-k)$

v) $\delta(n+k)$ vi) $a^n \cup(n)$

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5. Perform the circular convolution of the sequences using DFT-IDFT. **13**

$x_1(n) = \{\underset{\uparrow}{1}, 2, 3, 1\}$ & $x_2(n) = \{\underset{\uparrow}{4}, 3, 2, 2\}$

OR

6. Given $x(n) = \{1, 2, 3, 4, 4, 3, 2, 1\}$ find x(k) using DIT FFT algorithm. **13**

7. a) Convert the analog filter with system function: $H(s) = \dfrac{s + 0.1}{(s + 0.1)^2 + 9}$ into a digital IIR filter using Bilinear transformation Assume $W_r = \pi/4$ **6**

b) Given $H(s) = \dfrac{1}{(s+1)(s+2)}$ find corresponding H(z) using impulse invariance method. **7**

OR

8. Design a second order Butterworth band pass filter with: **13**

i) Lower cut-off frequency = 210 Hz
ii) Higher cut-off frequency = 330 Hz
iii) Sampling frequency = 960 samples per second using Billinear transform

9. Design an ideal low pass filter with a frequency response **14**

$$H_d(e^{j\omega}) = \begin{cases} 1, & -\pi/2 \le \omega \le \pi/2 \\ 0, & \pi/2 \le |\omega| \le \pi/2 \end{cases}$$

Determine h(n) & H(z) for M = 11 and plot the magnitude response.

OR

10. Design a filter with **14**

$$H_d(e^{-j\omega}) = \begin{cases} e^{-j3\omega} & ; \ -\pi/4 \le \omega \le \pi/4 \\ 0 & ; \ \pi/4 < |\omega| < \pi \end{cases}$$

using a Hamming window with M = 7

11. a) Explain the sub-band coding of speech signal with the help of block diagram. **7**

b) Obtain the O/P signal y(n) from the input signal x(n) as shown below **6**

$x(n) = \{0, 2, 4, 6, 3, 5, 7, 8\}$

OR

12. a) Explain typical applications of TMS 320 processor. **8**

b) What is multirate signal processing? Explain the application of multirate signal processing? **5**

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