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

Digital Signal Processing (DSP)

P. Pages : 2 **NKT/KS/17/7380/7385**

Time : Three Hours * 0 3 4 5 * 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.
10. Illustrate your answers whenever necessary with the help of neat sketches.
11. Use of non programmable calculator is permitted.

1. a) The analog signal given below is sampled by 600 samples per second, **4**

$m(t) = 2\sin 480\pi t + 3\sin + 20\pi t$

Calculate :

i) Nyquist - sampling rate

ii) Folding frequency

iii) What are frequencies in radions. In discrete time signal x(n)

b) For the following system determine whether the system is - **10**

i) Linear ii) Causal

iii) Time invariant iv) Memory less

v) Stable

$y(n) = x(n) + 3n\, x(n+1)$

OR

2. a) "Circular convolution is compress version of linear convolution" Justify the statement. **7**

b) Compute convolution $y(n) = x(n) * h(n)$ of the following pair of signal. **7**

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

3. a) Determine the z-transform with ROC of the signal. **6**

$x(n) = \{\underset{\uparrow}{1}, 2, 3, 4, 5, 6, 1\}$

b) State and prove convolution and differentiation property of ZT. **7**

OR

4. a) Determine all possible signals that the following ZT can have x(z) Calculate Drop Inverse **7**

Z transform. $x(z) = \dfrac{1}{1 - 0.5z^{-1} + 0.25z^{-2}}$

b) Determine the step response of the system $y(n) = ay(n-1) + x(n)\ ;\ -1 < a < 1$ when initial condition is $y(-1) = 1$, using unilateral z-transform. **6**

5. a) Obtain circular convolution of following two sequences using DFT-IDFT method. **14**

$x_1(n) = \{1, 2, 3, 4\}$

$x_2(n) = \{4, 5, 6, 7\}$

OR

6. Find 8 point DFT of the following sequence using decimation in frequency (DIF-FFT) algorithm $x(n) = (-1)^n;\ 0 \le n \le 7$ **14**

Also compute no. of complex additions and multiplication required.

7. The transfer function of discrete time causal system is given by **13**

$$H(z) = \frac{1 - z^{-1}}{1 - 0.2z^{-1} - 0.15z^{-2}}$$

Draw all four structures i.e.

i) Direct form - I ii) Direct form - II

iii) Cascade iv) Parallel.

OR

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

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

$|H(w)| \le 0.2 \ldots\ldots 0.6 \le w \le w$

9. Design a low pass FIR filter using Hamming window to meet the following specifications **13**

$H_d(w) = 1 \quad \text{for} \quad -\frac{\pi}{6} \le w \le \frac{\pi}{6}$

$= 0 \quad \text{otherwise}$

Use 10 tap filter and obtain impulse response of desired filter.

OR

10. a) Design an FIR digital filter to approximate an ideal LPF with passband gain of unity, cut-off frequency of 850 Hz and working at sampling frequency of 5000 Hz. The length of impulse response should be 5. Use rectangular window. **9**

b) Compare between IIR and FIR filters. **4**

11. a) What do you mean by multirate signal processing ? **3**

b) Explain decimation and interpolation with basic block diagram. **4**

c) Given the sequence x(n) is x(n) = {1, 2, 3, 6, 4, 3, 2, 1, 3, 3, 1} **6**
Find the decimated o/p y(n) when D = 2.

OR

12. a) Explain sub b and coding of speech signals with the help of block diagram. **7**

b) Explain sampling rate conversion by the rational factor I/D with block diagram. **6**

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