(b) The desired response of a low-pass filter is

$$H_d(e^{j\omega}) = \begin{cases} e^{-j3\omega}, & -3\pi/4 \le \omega \le 3\pi/4 \\ 0, & \dfrac{3\pi}{4} < |\omega| \le \pi \end{cases}$$

Determine $H(e^{j\omega})$ for M=7 using a Hamming window. (7)

(c) Using bilinear transformation obtain H(z) if

$H(s) = \frac{2}{(s+1)(s+3)}$ with T=0. 1s. (4)

[This question paper contains 8 printed pages.]

Your Roll No..............

Sr. No. of Question Paper : 5508 **J**

Unique Paper Code : 2512013601

Name of the Paper : Digital Signal Processing

Name of the Course : **B.Sc. (H) Electronics (Core)**

Semester : VI

Duration : 3 Hours Maximum Marks : 90

Instructions for Candidates

1. Write your Roll No. on the top immediately on receipt of this question paper.
2. There are **seven** questions in all, out of which you have to attempt any **five** questions.
3. **First** question is compulsory.
4. **All** questions carry equal marks.
5. Use of Non programmable Scientific Calculator is allowed.

1. (a) Express the given sequence x[n] in terms of unit impulse signals. (3)

$$x[n] = \{1, -2, 4, -6, 3, 2, 1\} \text{ for } -3 \leq n \leq 3$$

(b) Determine whether the system $y[n] = n\ u[n]$ is linear and shift invariant system. (3)

(c) Draw the pole-zero plot for the system described by the given difference equation. (3)

$$y[n] - \frac{3}{4}y[n-1] + \frac{1}{8}y[n-2] = x[n] - x[n-1]$$

(d) Find the final value of the signal x[n], for the X[z] given below. (3)

$$X[z] = \frac{2Z^{-1}}{1 - 1.8Z^{-1} + 0.8Z^{-2}}$$

(c) Distinguish between linear and circular convolution of two sequences. (4)

6. (a) By using butterfly structure for Decimation-In-Frequency (DIF) FFT algorithm, find DFT of the sequence (12)

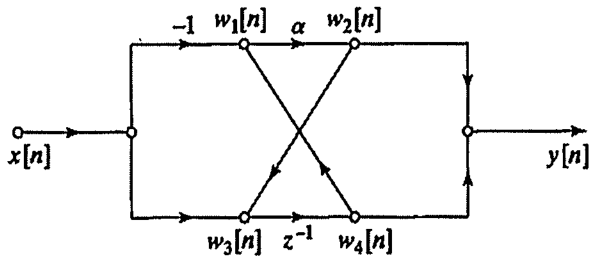
$$x[n] = \{1, 2, 3, 4, 4, 3, 2, 1\}.$$

(b) Given X(k)= {6, -2+j2, -2, -2-j2). Compute x[n] using 4-point inverse FFT. (6)

7. (a) An Analog filter has the following system function

$$H(s) = \frac{1}{s^2+1}$$

Convert this filter into a digital filter using backward difference for the derivative. Assume T=1s. (7)



(c) Determine the transfer function of the FIR filter with impulse response h[n] given by (4)

$$h[n] = \left(\frac{1}{2}\right)^n (u[n] - u[n-5])$$

5. (a) If h[n]= {1,2,4,2} and x[n]= {1,2}. Find linear convolution by computing circular convolution. (7)

(b) Determine the 4-point DFT of the sequence $x[n]=2^n$. (7)

(e) State Symmetry and Periodicity property of Twiddle factor. (3)

(f) What are the advantages of FIR filter over IIR filter? (3)

2. (a) The impulse response h[n] of a LTI system is

$$h[n] = 0.6^n u[n]$$

Find its frequency response, magnitude and phase response. (3)

(b) The impulse response of an LTI system is given below. (7)

$$h[n] = [1, -2, -2, 4]$$

Find the response of the system y[n], for the input x[n] = [1, 1, 0, 1, 1].

(c) Find the inverse discrete Fourier transform x[n] of the rectangular pulse spectra X(ω) defined as

$$X(\omega) = 1 \qquad |\omega| \leq W$$
$$= 0 \qquad W < |\omega| \leq \pi$$

Sketch the waveform in the frequency as well as discrete time domain. (4)

3. (a) Determine the inverse z-transform of (7)

$$X[z] = \frac{Z}{3Z^2 - 4Z + 1}$$

If the region of convergence is

(i) $|Z| > 1$.

(ii) $|Z| < \frac{1}{3}$.

(iii) $\frac{1}{3} < |Z| > 1$.

(b) Determine the z-transform and the ROC of the signal (7)

$$x[n] = \left(\frac{1}{2}\right)^n u[n] + 2^n u[-n-1]$$

(c) A system has an impulse response h[n] = {1 2 3} and output response y[n] = {1 1 2 –1 3}. Determine the input sequence x[n]. (4)

4. (a) Obtain the block diagram for Direct form-I and Direct form-II for the difference equation given below. (7)

$$y[n] + 0.6y[n-1] + 0.34y[n-2] - 0.4y[n-3]$$
$$= 0.56x[n-1] + 0.638x[n-2] + 0.08x[n-3]$$

(b) Determine the system function from the flow graph given in fig below. (7)