(c) What is the advantage of using a Hamming window in FIR filter design? (6)

[This question paper contains 8 printed pages.]

Your Roll No.....

Sr. No. of Question Paper : 1727 **L**

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. **All** questions carry equal marks.
4. **First** question is compulsory.

1. (a) Define Infinite Length Sequence. Give examples of Right sided, Left sided and two-sided infinite length sequences. (3)

(b) Determine whether the following system is shift-invariant or not:

$y(n) = x(n) + x(n-1) + x(n-2)$ (3)

(c) Distinguish between Decimation-in-Time (DIT) FFT and Decimation-in-Frequency (DIF) FFT. Mention any two differences. (3)

(d) Explain the circular convolution property of the DFT. Show how circular convolution in time domain relates to multiplication in the frequency domain. (3)

(e) Find the Z-transform of x[n-2] where x[n] = (0.5)^n u[n]. (3)

(b) Given X(k) = {36, –4 + j9.656, –4 + j4, –4 + j1.656, –4, –4 –j1.656, –4 – j4, –4 – j9.656}, find x(n). (9)

6. (a) Given $x(n) = 2^n$ and N = 8, find X(k) using DIF FFT algorithm. (9)

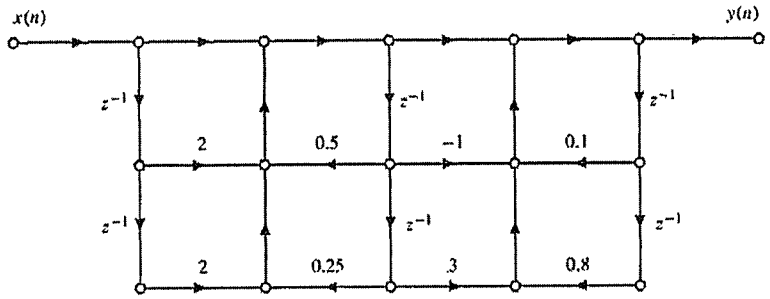
(b) Using the Linearity property, find the DFT of x[n] = 2[1, 2, 3, 4] + 3[4, 3, 2, 1]. (4)

(c) Using Differentiation Property, Find the DTFT of nx[n] where x[n] = (0.5)^n u[n]. (5)

7. (a) Design a low-pass FIR filter with cutoff frequency 0.2π rad/sample and filter length 11. (6)

(b) Determine the stability of a filter with impulse response h[n] = (0.5)^n u[n]. (6)

P.T.O.



5. (a) Consider the sequence

$$x(n) = \delta(n) + 2\delta(n-2) + \delta(n-3)$$

(i) Find the four-point DFT of x(n).

(ii) If y(n) is the four point circular convolution of x(n) with itself, find y(n) and the four point DFT of Y(k).

(iii) With $h(n) = \delta(n) + \delta(n-1) + 2\delta(n-3)$, find the four point circular convolution of x(n) with h(n). (9)

(f) What is the main difference between FIR and IIR filters? (3)

2. (a) Given the sequence

$$x[n] = (6-n)(u[n] - u[n-6])$$

Make a sketch of x(n) and $y_1(n)$, where, $y_1[n] = x[8-3n]$. (6)

(b) Define an accumulator system. Prove that an accumulator system is a Time invariant system. (6)

(c) Find the Fourier transform LSI system with unit sample response

$$h[n] = \delta[n] + 6\delta[n-1] + 3\delta[n-2]$$ (6)

3. (a) Find the z-transform of a right sided exponential sequence

$$x[n] = a^n u[n]$$

P.T.O.

Plot the z transform in a z-plane indicating the ROC, zeros and poles. Does the Fourier transform exist. (8)

(b) Obtain the power series expansion of

$$X(z) = \frac{1}{1-az^{-1}} \quad , \quad |z| = |a| \qquad (5)$$

(c) Explain the Time shifting property of z- transform using an example. (5)

4. (a) The following information is known about an LTI system :

(i) The system is causal

(ii) When the input is

$$x[n] = -\frac{1}{3}\left(\frac{1}{2}\right)^n u[n] - \frac{4}{3}(2)^n u[-n-1]$$

Then the z-transform of the output is

$$y(z) = \frac{1-z^{-2}}{\left(1-\frac{1}{2}z^{-1}\right)(1-2z^{-1})}$$

(a) Find the z-transform of x[n].

(b) What are the possible choices for the ROC ofy(z)?

(c) What are the possible choices for a linear constant coefficient difference equation used to describe the system?

(d) What are the possible choices for the impulse response of the system? (9)

(b) Find the system function of the following network (9)