R18

Code No: 156AR

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

B. Tech III Year II Semester Examinations, August - 2022

DIGITAL SIGNAL PROCESSING

(Common to ECE, EIE)

Time: 3 Hours Max.Marks:75

Answer any five questions

All questions carry equal marks

1.a) Find the impulse response $h[n]$ of the system described by the difference equation $8y[n] + 6y[n-1] = x[n]$

b) Discuss the sampling rate conversion by a factor I with the help of a neat block diagram.

c) Define time invariant system. Show that the interpolator is a time-variant system. [5+5+5]

2.a) Check the following filter for time invariant, causal and linear.
(i) $y(n) = (n-1)x^2(n+1)$ (ii) $y(n) = n^2x(n-2)$

b) Explain the frequency domain representation of discrete time signals.

c) Explain the terms: i) Up – sampling ii) Down- sampling. [5+5+5]

3.a) Determine the Inverse Z-Transform of $X(Z) = \frac{1}{(1-Z^{-1})(1-Z^{-1})^2}$.

b) Find the linear convolution of the sequences x[n] = {1,4,0,9, -1} and h[n]= {-3, -4,0,7}.

c) Compute the DFT of the sequence x(n) = sin[nπ/4], where N=8 using DIT FFT algorithm. [5+5+5]

4.a) Write five properties of DFS.

b) Find the Laplace transform of the following function $f(t) = te^{2t}Sin(3t)$.

c) Given x(n) = {1,2,3,4,4,3,2,1}, find X(k) using DIF FFT algorithm. [5+5+5]

5.a) Design a Chebyshev filter with a maximum passband attenuation of 2 dB; at Ωp=20rad/sec and the stopband attenuation of 35 dB at Ωs=50 rad/sec.

b) Obtain the impulse response of digital filter to correspond to an analog filter with impulse response $ha(t) = 0.5\,e^{-2t}$ and with a sampling rate of 1.0kHz using impulse invariant method. [7+8]

6.a) Differentiate "maximally flat magnitude response" and "equiripple magnitude response" filters.

b) Convert the analog filter to a digital filter whose system function is $H(S) = \frac{1}{(S+2)^2(S+1)}$. Use bilinear transformation. [8+7]

7.a) What is a Kaiser window? In what way is it superior to other window functions?

b) Using a rectangular window technique, design a low pass filter with pass band gain of unity, cut-off frequency of 1000Hz and working at a sampling frequency of 5 KHz. The length of the impulse response should be 7. [7+8]

8.a) Using the z-transform, find the total solution to the following difference equation with initial conditions, for discrete time $n \geq 0$.
$5y[n+2] - 3y[n+1] + y[n] = (0.8)^n u[n]$, $y[0] = -1$, $y[1] = 10$

b) Determine direct form I and cascade realization of the following system: [8+7]

$$H(z) = \frac{2\left(1-z^{-1}\right)\left(1+\sqrt{2}z^{-1}+z^{-2}\right)}{\left(1+0.5z^{-1}\right)\left(1-0.9z^{-1}+0.81z^{-2}\right)}$$

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