1T01035 - T.E.(Electronics and Telecommunication)(SEM-V)(Choice Base Credit Grading System) (R-20-21) (C Scheme) / 32222 - Discrete Time Signal Processing

QP CODE:10013805 DATE: 24/11/2022

Duration: 3hrs **[Max Marks:80]**

N.B. : (1) Question No 1 is Compulsory.
(2) Attempt any three questions out of the remaining five.
(3) All questions carry equal marks.
(4) Assume suitable data, if required and state it clearly.

1 Attempt any FOUR [20]

a Find the DFT of x[n]={5, 6, 7, 8}. Using answer and not otherwise find DFT of x1[n]={8, 5, 6, 7}.

b Find the impulse response if the frequency response of the system is given as $H(e^{j\omega}) = e^{-j3\omega}(1 + 0.5\cos\omega - 0.95\cos 2\omega)$

c Realize the linear phase FIR filter given as $h[n] = \{1, -0.5, 0, 0.5, -1\}$ using minimum number of multipliers.

d For linear phase FIR filter, one of the zeros is at $0.2e^{j\frac{\pi}{3}}$. Find other compulsory zeros for Odd Symmetric FIR filter. Determine the transfer function.

e Compare FIR filters with IIR filters

2 a Find the DFT of a real sequence x[n] ={1, -2, 3, 5, 1, 3, -4, 2} using DIT FFT. [10]

b The second order IIR filter is defined as [10]

$$H(z) = \frac{1}{(1 - 0.95z^{-1} + 0.225\,z^{-2})}$$

Determine the shift of poles in direct form and cascade form realization if coefficients are represented by 3 bits.

3 a Determine the digital IIR digital filter from analog filter transfer function which is given as $H(s) = \frac{10}{(s^2+7s+15)}$ with T=0.02sec. using impulse invariant transformation method. [10]

b Find DFT of x1[n]={1, 4, 3, -2} and x2[n]={1, -2, 4, 5} using DIF FFT only once. [10]

4 a Design a digital filter with flat passband and flat stopband which satisfies following constraints using bilinear transformation method. Assume Ts=0.1s. [10]

$0.8 \leq |H(e^{j\omega})| \leq 1 \quad 0 \leq \omega \leq 0.25\pi$

$|H(e^{j\omega})| \leq 0.2 \quad 0.65\pi \leq \omega \leq \pi$

b Find the output of the system having impulse response h[n]={2,1,2} for input sequence x[n]={1, -2, 4, 5, 3, 2, 2, 1, 5, 7, -3, -1, 4, 2} using Overlap-save Method (Assume N=6). [10]

5 a Design a digital FIR filter using Hanning window for M=7 for given specifications. [10]

$$H(e^{j\omega}) = \begin{cases} e^{-j3\omega} & ; \quad \frac{\pi}{8} \leq |\omega| \leq \frac{\pi}{4} \\ 0 & ; \quad \text{otherwise} \end{cases}$$

b Realize the filter function by lattice realization structure. [10]

$H(z) = 1 + \frac{3}{4}z^{-1} + \frac{1}{2}z^{-2} + \frac{1}{4}z^{-3}$

6 a Explain group delay and phase delay. [6]

b Explain how DTSP is used in echo cancellation process. [7]

c Write a short note on Limit cycle oscillations [7]
