RGM COLLEGE OF ENGINEERING & TECHNOLOGY (AUTONOMOUS)

09th June 2023

III B.Tech. II Sem. (R20) End Examinations (Regular)

DIGITAL SIGNAL PROCESSING

ECE

Time: 3 Hrs **Total Marks: 70**

Note 1:Answer Question No.1 (Compulsory) and 4 from the remaining

2:All Questions Carry Equal Marks

1a Define the poles and zeros of a system function?

b What are the steps to design a FIR filter using windowing techniques?

c Convert the Transfer function $H(s)=\frac{1}{(s^2+7s+12)}$ into H(z) by using Impulse Invariant method.

d Find the DFT of the sequence x(n)={1,1,0,0}.

e Draw the block diagram of multistage decimator and interpolater.

f Draw the flow graph of a two-point radix-2 DIF-FFT.

g How many numbers of additions, multiplications and memory locations are required to realize a system H(z) having M zeros and N poles in Direct form-I and direct form –II ?

2 Design a digital Chebyshev filter to satisfy the constraints

$$0.707 \le \left|H\left(e^{j\omega}\right)\right| \le 1, \quad 0 \le \omega \le 0.2\pi$$

$$\left|H\left(e^{j\omega}\right)\right| \le 0.1, \quad 0.5\pi \le \omega \le \pi$$

Using bilinear transformation assuming T= 1 second

3 For desired frequency response

$$H_d(e^{j\omega}) = e^{-j3\omega} \quad \frac{-\Pi}{8} \le \omega \le \frac{\Pi}{8}$$

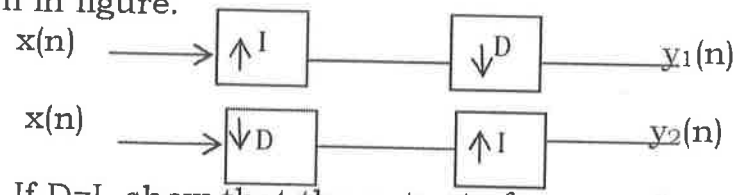
$$=0 \quad \frac{\Pi}{8} \le |\omega| \le \Pi$$

Determine $H(e^{j\omega})$ for N=7 and compare the response for

a) Hamming window

b) Hanning window

4 a) Consider the two different ways of cascading a decimator with an interpolator as shown in figure. (10)



i. If D=I, show that the output of two configurations are different.

ii. Show that two systems are identical if and only if D and I are relatively prime.

b) For the IIR filter with transfer function $H(z) = \frac{1}{1-az^{-1}}$ determine $H_0(z)$ and $H_1(z)$ for the two-component decomposition. (4)

5 a) Compute the eight-point DFT of the sequence $x(n)=\left\{\frac{1}{2},\frac{1}{2},\frac{1}{2},\frac{1}{2},0,0,0,0\right\}$ using the in-place radix-2 DIT-FFT. (11)

b) Draw the radix-2 DIF-FFT. (3)

6 Test the stability of LTI systems, whose impulse response are,

a) $h(n)=(0.2)^n u(n)$.

b) $h(n)=(0.3)^n u(n)+2^n u(n)$.

c) $h(n)=4^n u(-n)$.

d) $h(n)=(0.2)^n u(-n)+3^n u(-n)$.

7 Consider a second – order LTI system described by the difference equation, $y(n)=\frac{1}{16}y(n-2)+x(n)$

a) Determine the unit sample response, h(n) of the system

b) Determine the direct form –II, parallel-form and cascade-form realizations of the system.

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