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Code No: 126VK

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

B. Tech III Year II Semester Examinations, July - 2023

DIGITAL SIGNAL PROCESSING

(Electronics and Communication Engineering)

Time: 3 Hours **Max. Marks: 75**

Note: i) Question paper consists of Part A, Part B.
ii) Part A is compulsory, which carries 25 marks. In Part A, Answer all questions.
iii) In Part B, Answer any one question from each unit. Each question carries 10 marks and may have a, b as sub questions.

PART – A

(25 Marks)

1.a) Find the period of $x(n) = \cos [8\pi n/7 + 2]$. [2]
b) Given $x[n] = (0.5)^n u[n]$, find the signals z-transform X(z) and the corresponding ROC. [3]
c) Compare Over-Lap add method and Over-Lap save method. [2]
d) Find the DTFT of the sequence $x(n) = a^n u(n)$. [3]
e) Explain warping effect. [2]
f) Draw the direct form structure of IIR. [3]
g) Compare IIR and FIR filter. [2]
h) Show that the h(n) = [-1,0,1] is a linear phase filter. [3]
i) What are the quantization error due to finite word length register in digital filter? [2]
j) Draw a labelled block diagram of a unity-gain multirate signal processing system that converts an input signal with sampling frequency 8 kHz to an output signal with sampling frequency 12 kHz. [3]

PART – B

(50 Marks)

2. A discrete time system can be a) Static or Dynamic b) Linear or nonlinear c) Time invariant or time varying d) Causal or Non-Causal e) Stable or unstable. Examine the system y(n)= x(-n+2) with respect to the properties mentioned in the question. [10]

OR

3. Realize the system y(n) = 3/4 y(n-1) -1/8 y(n-2) + x(n) + 1/3 x(n-1), using cascade form and parallel form. [10]

4.a) What do you mean by Radix-2 FFT? Draw the basic butterfly diagram of radix -2 FFT.
b) Compute an 8-point DFT using DIF FFT radix -2 algorithm. x(n) = {1,2,3,4,5,6,7,8}. [4+6]

OR

5. x(n)= {0.5,0.5,0.5,0.5,0,0,0,0}. Compute the DFT of the sequence using the inplace radix 2 DIF-FFT algorithm. [10]

6. Determine H(Z) using impulse invariant technique for the analog transfer function $(s) = H(S) = 1/ (S+1)(S+2)$. Assume T=1 sec. [10]

OR

7. Design an analog Butterworth filter that satisfies the following constraints: [10]

$$0.9 \leq |H(j\Omega)| \leq 1; \quad 0 \leq \Omega \leq 0.2\pi$$
$$|H(j\Omega)| \leq 0.2; \quad 0.4\pi \leq \Omega \leq \pi$$

8. Describe the design of FIR filter using frequency sampling technique. [10]

OR

9. Design an ideal High Pass Filter the frequency of

$$H_d(e^{j\omega}) = 1 \text{ for, } \pi/4 \leq |\omega| \leq \pi$$
$$= 0 \text{ for } |\omega| \leq \pi/4$$

Using Hanning window with N=11. [10]

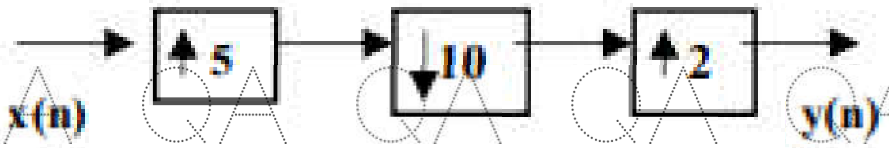
10. Discuss the steps involved in converting sampling rate by a factor of I/D. [10]

OR

11.a) Determine the characteristics of a limit cycle oscillation with respect to the system described by the difference equation y(n) =0.95y(n-1)+x(n). Determine the dead band of the filter, when x(n) = +0.875 for n=0 and y(-1)=0. Assume 4 bit sign magnitude representation.

b) Develop an expression for y(n) as a function of x(n) for the given multirate system:

[5+5]



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