PRESIDENCY UNIVERSITY
BENGALURU

SET A

SCHOOL OF ENGINEERING
END TERM EXAMINATION - JAN 2024

Semester : Semester V - 2021
Course Code : EEE3014
Course Name Digital Signal Processing Systems
Program : B.Tech.

Date : 08-JAN-2024
Time : 9:30AM - 12:30 PM
Max Marks : 100
Weightage : 50%

Instructions:
(i) Read all questions carefully and answer accordingly.
(ii) Question paper consists of 3 parts.
(iii) Scientific and non-programmable calculator are permitted.
(iv) Do not write any information on the question paper other than Roll Number.

PART A

ANSWER ALL THE QUESTIONS   **5 X 2M = 10M**

1. Define linear convolution and circular convolution.

   (CO1) [Knowledge]

2. Radix 2 *FFT* algorithm converts the time domain N point sequence x(n) to a frequency domain N-point sequence X(k). State the applications of Radsix 2 FFT algorithms.

   (CO2) [Knowledge]

3. Filter design is a critical aspect of signal processing, aiming to shape the frequency characteristics of a signal by allowing certain frequency components to pass through while attenuating others. State the design steps of Chebyshev filters.

   (CO3) [Knowledge]

4. What is linear phase FIR filter?List the different ways of analyzing the FIR filter.

   (CO4) [Knowledge]

5. State the differences between Digital signal processing and Analog signal processing.

   (CO1) [Knowledge]

ANSWER ALL THE QUESTIONS **5 X 10M = 50M**

6. Two persons x1 & x2 start from the same town for selling different types of DSP processors. At the starting point(origin), each person has seven dollars with them. After one-hour salesperson x1, has sold his processors for six dollars but person x2 has eight dollars. At the end of the second hour sales period, person x1 has sold for 2 dollars when x2 has only one dollar. Similarly, for the third hour sales period both have only one dollar sales. Now they wish to consider the amount (what they have) according to the sales period as a discrete sequence representation. Further, they wish to show the cyclic amount of sales as a discrete sequence to his owner. Assuming yourself as a owner estimate the cyclic sequence of the amount.

(CO1) [Comprehension]

7. Computing the Inverse Discrete Fourier Transform (IDFT) using the Fast Fourier Transform (FFT) algorithm involves applying the FFT algorithm to the complex conjugate of the input sequence and then normalizing the result. For the given x(k)= { 7, -0.707-j0.707, -j, 0.707-j0.707, 1, 0.707-j0.707,j, 1,-0.707+j0.707 } find x(n) using radix2-DIFFFT algorithm.

(CO2) [Comprehension]

8. Butterworth filters are employed in radar systems for tasks such as pulse shaping, target detection, and clutter rejection. Their smooth frequency response is beneficial in these applications and it is required to design an analog Butterworth filter for target detection that has a -2db pass band attenuation at a frequency of 20 rad/sec an at least -10 db stop band attenuation at 30 rad/sec.

(CO3) [Comprehension]

9. For audio processing the given difference equation is used.
y(n)=x(n)+3x(n-1)+2x(n-2)+3x(n-3)+x(n-4)
obtain the non recursive structure of y(n) using minimum multiplier.

(CO4) [Comprehension]

10. The Radix-2 FFT is extensively used in signal processing applications, such as audio and image processing, telecommunications, and various scientific and engineering fields. The following signal has been captured from the fault diagnosis.
x(n) = (1,2,3,4,5,6,7,8). Using radix2-DIFFFT algorithm, compute Fourier Transform of x(n) sequence.

(CO2) [Comprehension]

PART C

ANSWER ALL THE QUESTIONS **2 X 20M = 40M**

11. In image and video processing, digital filters are applied for tasks such as blurring, sharpening, edge detection, and noise reduction. They contribute to enhancing image quality and extracting relevant features. For the analog transfer fucntion H(s) = 2 / *(s+1)(s+2)*. Evlaute the digital transfer function using impulse invariant method by consdering T= 1 sec. Also realize the digital filter structure using any two methods.

(CO3) [Application]

12. Design a filter whose desired frequency response is given as
Hd (ω) = **e^(- 5jω)** for (− π /2) ≤ ω ≤ (π/2)
= 0 otherwise
using Blackman window with N = 11.
You MUST ONLY use the Blackman window function given below:

W(B) = 0.42 + 0.5cos (2πn/N-1) +0.08cos (4πn/N-1) for -(N-1)/2 ≤ n ≤ N-1/2

= 0 otherwise

Also find the frequency response.

(CO4) [Application]