Code No: 156AR **R18**

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD
B. Tech III Year II Semester Examinations, March - 2024
DIGITAL SIGNAL PROCESSING
(Common to ECE, EIE)

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)	Describe the terms: i) Up – sampling ii) Down- sampling.	[2]
b)	Give the frequency domain representation of discrete time signals.	[3]
c)	What are the advantages FFT over DFT?	[2]
d)	Find the IDFT of Y (k) = (1, 1, 1, 0).	[3]
e)	Write the applications of FFT algorithm.	[2]
f)	Distinguish the Butterworth and Chebyshev filters.	[3]
g)	What are the effects of windowing?	[2]
h)	What is the necessary and sufficient condition for linear phase characteristics of an FIR filter?	[3]
i)	Distinguish between truncation and rounding of binary digits with example.	[2]
j)	What are characteristics between S-plane and Z-plane?	[3]

PART - B

(50 Marks)

2.a) Check whether the given systems are linear, shift variant, causal and stable
(i) $y(n) = x[4n + 1]$ (ii) $y(n) = log_{10}x[n]$
b) What is Interpolation? Explain about the frequency domain description of an Interpolator. [5+5]

OR

3.a) Determine the impulse response of the difference equation
Y(n)+3y(n-1) +2y(n-2) =2x(n)-x(n-1)
b) Discuss the sampling rate conversion by a factor I with the help of a neat block diagram. [5+5]

4.a) Find the linear convolution of the sequences x[n]={ 1,4,0,9,-1} and h[n]= {-3,-4,0,7}.
b) Find the DFT of the following sequence using DIF FFT? x(n) = {1,2,3,5,5,3,2,1 }. [5+5]

OR

5.a) State and prove any three properties of Z-Transform.
b) Compute the DFTs of the sequence $x(n) = 2^{-n}$, where N = 8 using DIT algorithm. [5+5]

6.a) Use bilinear transformation method to find H(z) for $H(s) = {}^{1}/_{(s+o.5)^2}$

b) Explain the features of Chebyshev approximation. [5+5]

OR

7.a) By impulse invariant method obtain the digital filter transfer function and the differential equation of the analog filter H(s) =1/s+1.

b) Design a digital Butterworth filter that satisfies the following constraint using bilinear transformation. Assume T=1sec. [5+5]

$0.9 \le |H(e^{jw})| \le 1 \qquad 0 \le w \le \frac{\pi}{2}$

$|H(e^{jw})| \le 2 \qquad \frac{3\pi}{4} \le w \le \pi$

8.a) Design a HPF of length 7 with cut off frequency of 2 rad/sec using Hamming window.

b) Design a linear phase FIR filter using frequency sampling method. [5+5]

OR

9.a) Determine the frequency response of the FIR filter defined by
y(n)= 0.25x(n)+ x(n-1) + 0.25x(n-2)

b) Explain about the Rectangular window of the FIR filter. [5+5]

10.a) Obtain the direct form-I, direct form –II form realization of the following system function
Y(n)=-0.1 y(n-1)+0.2y(n-2)+3x(n)+3.6x(n-1)+0.6x(n-2)

b) Draw the quantization noise model for a second order system with system function. [5+5]

OR

11.a) Develop the Cascade form of the following causal IIR transfer function

$$H(z) = \frac{(3+5z^{-1})(0.6+3z^{-1})}{(1-2z^{-1}+2z^{-2})(1-z^{-1})}$$

b) Explain about the zero-input limit cycle oscillations due to finite word length of registers. [5+5]

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