Course Code: 1960420 Roll No: **MLRS-R19**

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INSTITUTE OF TECHNOLOGY AND MANAGEMENT
(AN AUTONOMOUS INSTITUTION)
(Approved by AICTE, New Delhi & Affiliated to JNTUH, Hyderabad)
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III B.Tech II Sem Supply End Examination, January 2023

Digital Signal Processing

(Electronics and Communication Engineering)

Time: 3 Hours. **Max. Marks: 70**

Note: 1. Question paper consists: Part-A and Part-B.
2. In Part – A, answer all questions which carries 20 marks.
3. 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

(10*2 Marks = 20 Marks)

1.	a)	With considering a suitable example explain how an analog signal can be converted into a discrete time signal.	2M	CO1	C1
	b)	Give a time domain equation for down sampling operation.	2M	CO1	C2
	c)	List the properties of twiddle factor.	2M	CO2	C2
	d)	Find the 4-point DFT of the following sequence using matrix method. $x(n)=\{1, 1, 1, 1\}$	2M	CO2	C1
	e)	Compare the Butterworth and Chebyshev filter approximations.	2M	CO3	C2
	f)	Show that the impulse invariance method will convert stable analog filter into a stable digital filter.	2M	CO3	C3
	g)	Define phase delay and group delay.	2M	CO4	C1
	h)	Compare FIR and IIR filters.	2M	CO4	C2
	i)	Illustrate the role of Z-transforms in analysis and design of digital filters.	2M	CO5	C2
	j)	Suggest methods to prevent overflow in digital implementation.	2M	CO5	C1

PART- B

(10*5 Marks = 50 Marks)

2	a)	Check the causality and stability of following discrete time systems. (i) $y(n)=(0.7)^n u(n-1)$ (ii) $y(n)=(3)^n u(n)$	5M	CO1	C1
	b)	Explain the up-sampling operation and then develop a block diagram for interpolation.	5M	CO1	C2
		OR			
3		Plot the magnitude and phase response of transfer function $H(e^{jw})$ of the linear time invariant (LTI) system whose input and output satisfy the following difference equation. $y[n]-\frac{1}{4}y[n-1]=x[n]+3x[n-1]+2x[n-3]$	10M	CO1	C2

4 a) Find the convolution of the following two causal sequences using overlap save method. (5M, CO2, C1)

$h(n)=\left\{\underset{\uparrow}{-2},1,-2\right\}\ x(n)=\left\{\underset{\uparrow}{2},3,-3,-1,1,-2,1,0,1,-3,-2,2,2,3,-2\right\}$

OR

5 Compute the 8-point IDFT of the following sequence using radix-2 DIF-FFT algorithm. (10M, CO2, C2)

$X(k)=\{1,2j,-2j,1,3,1j,-1j,2\}$

6 a) Convert the following analog filter transfer function into digital *IIR* filter $H(S)=\dfrac{1}{(S+0.1)^2+9}$ using impulse invariance method (5M, CO3, C1)

$(T = 1\ Sec)$

b) Give the list of all equations pertaining to frequency transformations. (5M, CO3, C2)

OR

7 Design a digital IIR Butterworth low pass filter for the following specification using Bilinear transformation method $(T = 1\ Sec)$. (10M, CO3, C3)

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

$\left|H(e^{jw})\right| \le 0.2 \qquad 3\pi/4 \le w \le \pi$

8 a) The following is a digital causal *FIR* filter, show that it exhibits a linear phase characteristics. (5M, CO4, C1)

$h(n)=\{c, b, a, 0, -a, -b, -c\}$.

b) Illustrate the concept of Gibbs phenomenon caused by rectangular window. Suggest how it can be eliminated. (5M, CO4, C2)

OR

9 Design a digital FIR filter using rectangular window for the following specifications. (10M, CO4, C2)

$H(e^{jw}) = e^{-j5w};\ \pi/4 \le |w| \le 3\pi/4$

$0 \quad ;\ otherwise$

10 a) With considering a suitable example explain the cascade structure of digital filter implementation. (5M, CO5, C2)

b) Explain the trade-off between round-off and overflow noise. (5M, CO5, C1)

OR

11 Draw the direct form-II structure of the following discrete time system. (10M, CO5, C1)

$y(n)=-0.1y(n-1)+0.2y(n-2)+3x(n)+3.6x(n-1)+0.6x(n-2)$

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