Reg. No. : | | | | | | | | | | | | |

Question Paper Code:U4B02

B.E./B.Tech. DEGREE EXAMINATION, NOV 2024

Fourth Semester

Biomedical Engineering

21UBM402 - PRINCIPLES DIGITAL SIGNAL PROCESSING

(Regulations 2021)

Duration: Three hours | Maximum: 100 Marks

Answer ALL Questions

PART A - (10 x 2 = 20 Marks)

1.	Draw the basic butterfly structure for radix-2 DIT algorithm?	CO1-U
2.	Find the IDFT of X(k) = {1,0,1,0}.	CO2-App
3.	Determine the order of the Chebyshev analog filter for the given Specification αp = 3db, αs = 16db, fp=1 kHz and fs= 2kHz	CO2-App
4.	Give the steps in the design of a digital filter into analog filter	CO1- U
5.	What are the properties of FIR filter??	CO1 –U
6	Write the procedure for FIR filter design by frequency sampling method.	CO1- U
7	Convert -25_{10} to 32-bit IEEE-754 format of binary and verify the result by converting the binary to decimal?	CO2-App
8	What is the overflow limit cycle? How it can be eliminated?	CO1 -U
9	Compare Harvard architecture and Von-Neumann architecture	CO1 -U
10	List any two instructions set of TMS320C54x Digital Signal Processors	CO1- U

PART – B (5 x 16= 80 Marks)

11.	(a)	(i) Compute 8-point DFT of the discrete time signal, x(n) ={2,2,2,2,1,1,1,1} using Radix-2 DIT FFT.	CO2- App	(10)
		(ii) Compute the circular convolution of the following two sequence using DFT $x_1(n)$= {0,1,0,1} and $x_2(n)$= {1,2,1,2}	CO2- App	(6)

Or

	(b)	(i) Compute 8-point DFT of the discrete time signal, x(n) = {-1,2,2,2,-1,0,0,0} using Radix-2 DIT FFT.	CO2-App	(6)
		(ii) Compute the 4 point DFT of causal three sample sequence is given by x(n)=1/8; 0<=n<=3 = 0; else	CO2-App	(6)
12.	(a)	Design a butterworth digital IIR filter using Bilinear Transform by taking T= 0.1 sec to satisfy the following specification Pass band ripple<=3.01dB Stop band attenuation >=13.997dB Pass band edge frequency=0.3π rad/sample Stop band edge frequency=0.75 π rad/sample	CO2-App	(16)
		Or		
	(b)	Design a Chebyshev digital IIR low pass filter using impulse invariant transformation by taking T= 1 sec, to satisfy the following specification. $0.9 \leq \lvert H(e^{j\omega}) \rvert \leq 1.0$; for $0 \leq \omega \leq 0.25\pi$ $\lvert H(e^{j\omega}) \rvert \leq 0.24$; for $0.5\pi \leq \omega \leq \pi$ Analyze the response of the transfer function if T=0.1 sec.	CO2-App	(16)
13.	(a)	Design a band pass filter using frequency sampling method for the specifications, Sampling frequency F= 8000Hz Cutoff frequency fc_1 =1000 Hz fc_2=3000 Hz Determine the filter coefficients for N=7. If N=5 what will be the filter coefficients?	CO2-App	(16)
		Or		
	(b)	Design a linear phase FIR BPF to pass frequency in the range 0.35π to 0.48π rad/sample using a rectangular window, by taking 5 samples of window sequence. Analyze the above with a Hamming window and comment about the result.	CO2-App	(16)
14.	(a)	A LTI system is characterized by the difference equation , y(n) =0.87y(n-1)+x(n). Determine the limit cycle behavior and the deadband of the system when x(0)= 0 and y(-1) = 0.61. Assume that the product is quantized to 4-bits by rounding.	CO5-App	(16)
		Or		

	(b)	In the IIR system given below the products are rounded to 4-bits (including sign bit). $H(z) = 1 / (1-0.35z^{-1}) (1-0.62z^{-1})$. Find the output round off noise power in a)direct form realization b) cascade realization	CO5-App	(16)
15.	(a)	(i) Write an assembly language program using instruction of TMS320C54x processor to find the sum of an array stored in memory. Assume that the array has 10_{10} data each of size 16 bits and store the sum in memory.	CO4-App	(8)
		(ii) Draw the simplified architecture of TMS320C6xx processor	CO1- U	(8)
		Or		
	(b)	(i) Write an assembly language program using instruction of TMS320C54x processors to multiply two numbers of unsigned 32-bit data. Assume that two data are available in memory. Save the 64-bit product in memory.	CO4-App	(8)
		(ii) List any five addressing modes of the TMS320C6xx processor with relevant examples.	CO1- U	(8)