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

Question Paper Code:U4B02

B.E./B.Tech. DEGREE EXAMINATION, APRIL 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.	Determine the circular convolution of the following two sequences $x(n)=\{1,2,2,1\}$ and $h(n)=\{1,0,0,1\}$	CO2-App
3.	What is bilinear transformation? What is the main advantages and disadvantages of the techniques	CO1-U
4.	Given that, $H(s)=1 / (s+1)$. By impulse invariant method, obtain the digital filter transfer function.	CO1-U
5.	What is mean by Gibb's phenomenon?	CO1-U
6.	Compare the rectangular window and hanning window.	CO1-U
7.	Convert $(+0.125)_{10}$ to 2's complement format of binary and verify the result by converting the binary to decimal.	CO2-App
8.	What is meant by product quantization error?	CO1-U
9.	List any two instructions set of TMS320C54x Digital Signal Processors.	CO1-U
10.	Compare Harvard architecture and Von-Neumann architecture.	CO1-U

PART – B (5 x 16= 80Marks)

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 the eight-point DFT of the sequence x(n)= {2,1,2,1,1,2,1,2} by using the DIF- FFT algorithm described in the text. CO2-App (10)

(ii) Compute the DFT of the Sequence, x(n) = {0,1,2,1}. Sketch the magnitude and phase spectrum CO2-App (6)

12. (a) Design a Chebyshev digital IIR low pass filter using impulse invariant transformation by taking T= 1 sec, to satisfy the following specification. **CO3-Ana** (16)

$0.9 \leq |H(ej\omega)| \leq 1.0$; for $0 \leq \omega \leq 0.25\pi$

$|H(ej\omega)| \leq 0.24$; for $0.5\pi \leq \omega \leq \pi$

Analyze the response of the transfer function if T=0.1 sec.

Or

(b) Design a Butter worth digital IIR Low pass filter using impulse invariant transformation by taking T=1sec, to satisfy the following specification. **CO3- Ana** (16)

$0.8 \leq |H(e^{j\omega})| \leq 1.0$; for $0 \leq \omega \leq 0.2\pi$

$|H(e^{j\omega})| \leq 0.2$; for $0.6\,\pi \leq \omega \leq \pi$

Analyze the response of the transfer function if T=0.5 sec

13. (a) Design an Ideal HPF with frequency response **CO2-App** (16)

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

$\mathbf{= 0, \text{ for } |\omega| \leq \pi/4}$

Using a Hamming window for N=11 samples.

Or

(b) Design an Ideal BPF with frequency response **CO2-App** (16)

$\mathbf{H_d(e^{jw}) = e^{-jw\alpha}, \text{ for } \pi/4 \leq |\omega| \leq \pi}$

$\mathbf{= 0, \text{ for } |\omega| \leq \pi/4}$

Using a Hanning window for N=7 samples

14. (a) In the IIR system given below the products are rounded to 4 bits(include sign bit) $H(z)= 1/ (1-0.15Z^{-1}) (1-0.43Z^{-1})$. Find the output round off noise power in (a) direct form realization (b) cascade form realization. **CO2-App** (16)

Or

(b) Explain the characteristics of a limit cycle oscillation with respect to the system described by the $y(n)= 0.82y(n-1)+x(n)$ when the product is quantized to 4 bits rounding. The system is excited by an input $x(n)=0.875$ for $n=0$ and $x(n) =0$ for $n \neq 0$ **CO2-App** (16)

15. (a) With a neat functional block diagram, explain the architecture of TMS320C5X processor and explain **CO1- U** (16)

Or

(b) List the addressing modes of the TMS320C6xx processor with relevant examples. **CO1- U** (16)