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

Question Paper Code: 95401

B.E. / B.Tech. DEGREE EXAMINATION, NOV 2022

Fifth Semester

Electronics and Communication Engineering

19UEC501 - Digital Signal Processing

(Regulations 2019)

Duration: Three hours Maximum: 100 Marks

Answer ALL Questions

PART A - (5 x 1 = 5 Marks)

1. If x(n) is a real sequence and X(k) is its N-point DFT, then which of the following is true? CO1- U

   (a)X(N-k)=X(-k) (b)X(N-k)=X*(k) (c) X(-k)=X*(k) (d) All of the above

2. The poles of Butterworth filter lies _____ in s-plane CO1- U

   (a) Sphere (b) Circle (c) Ellipse (d) Parabola

3. The frequency response of a digital filter is periodic in the range CO1- U

   (a) $0 < \omega < 2\pi$ (b) $-\pi < \omega < \pi$

   (c) $0 < \omega < \pi$ (d) $0 < \omega < 2\pi$ or $-\pi < \omega < \pi$

4. The Finite word length effects are due to, CO1- U

   (a) Quantization of input (b) Quantization of coefficients

   (c) Quantization of product (d) All the above

5. The MMRs of TMS320C5x processor can be directly addressed by, CO1- U

   (a) 7-bit address (b) 8-bit address (c) 9-bit address (d) 11-bit address

PART – B (5 x 3= 15 Marks)

6. Determine the linear Convolution of x(n) ={1,2,3,4} and h(n)={2,4,6} CO2- App

7. Determine the order of the Chebyshev analog filter for the given specification CO2 App

   αp = 3db, αs = 16db, fp=1 kHz and fs= 2kHz

8. How the constant group delay and phase delay achieved in linear phase FIR filters? CO1 R

9. What is meant by finite word length effects in digital filters? CO1 R

10. What are the internal buses of TMS320C54x processors? CO1 R

PART – C (5 x 16= 80 Marks)

11. (a) Compute 8-point DFT of the discrete time signal, CO2- App (16)

$x(n) = \{2,2,2,2,1,1,1,1\}$ using Radix-2 DIT FFT.

Or

(b) Compute 8-point DFT of the discrete time signal, CO2- App (16)

$x(n) = \{1,2,1,2,1,3,1,3\}$ using Radix-2 DIF FFT.

12. (a) Design a Butter worth digital IIR high pass filter using bilinear transformation by taking T=0.5 sec, to satisfy the following specification. CO3- Ana (16)

$$0.95 \leq |H(e^{j\omega})| \leq 1.0; \text{ for } 0 \leq \omega \leq 0.3\pi$$

$$|H(e^{j\omega})| \leq 0.2; \text{ for } 0.4\pi \leq \omega \leq \pi$$

Analyze the response of the transfer function if T=1 sec.

Or

(b) 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)

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

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

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

13. (a) Design a FIR low pass filter with cutoff of 1kHz and sampling frequency of 4kHz with 11 samples using Fourier series method. Determine the frequency response and verify the design by sketching the magnitude response. CO2- App (16)

Or

(b) Design a FIR high pass filter with cutoff of 1.5kHz and sampling frequency of 5kHz with 7 samples using Fourier series method. Determine the frequency response and verify the design by sketching the magnitude response. CO2- App (16)

14. (a) The Coefficients of a system defined by $H(z) = \frac{1}{(1 - 0.4z^{-1})(1 - 0.55z^{-1})}$ are represented in a number system with a sign bit and 3 data bits using signed magnitude representation and truncation. Determine the new pole locations for direct realization and cascade realization of first order systems CO2- App (16)

Or

(b) An 8 bit ADC system feeds a DSP system characterized by the following transfer function. Estimate the steady state quantization noise power at the output of the system. 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 TMS320C5X processor with relevant examples. CO1- U (16)

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