C **Reg. No. :** | | | | | | | | | | | | |

Question Paper Code: U5401

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

Fifth Semester

Electronics and Communication Engineering

21UEC501 - DIGITAL SIGNAL PROCESSING

(Regulations 2021)

Duration: Three hours Maximum: 100 Marks

Answer ALL Questions

PART A - (5 x 1 = 5 Marks)

1. What is the circular convolution of the sequences x1(n)={2,1,2,1} and x2(n)={1,2,3,4}? CO2-App

   (a) {14,14,16,16} (b) {16,16,14,14} (a) {14,14,16,16} (b) {16,16,14,14}

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

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

3. What is the value of α if the number of samples N=15 CO2-App

   (a) 15 (b) 15/2 (c) 14 (d) 7

4. In Quantization to b-bits(excluding sign bit), if R is the range, then quantization step size q is CO1-U

   (a) $R/2^b$ (b) $R/2^{b+1}$ (c) $R/2^{b-1}$ (d) $R\ 2^{b+1}$

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. Compute the N-point DFT of the signal x(n) = cos(nπ/4) for $0 \le n \le 3$. CO2-App

7. Given that, H(s)=1 / (s+1). By impulse invariant method, obtain the digital filter transfer function. CO2-App

8. The frequency response of a digital filter is, $H(e^{j\omega}) = (0.7+0.6\cos\omega - 0.9\cos^2\omega)e^{-j7.5\omega}$. Determine the phase delay and group delay. CO2-App

9. Compute the dead band for the equation y(n) = 0.95y(n-1) + x(n). When the product is rounded off to 5-bits by rounding. CO2-App

10. Compare Harvard architecture and Von-Neumann architecture. CO1-U

PART – C (5 x 16= 80 Marks)

11.	(a)	For the given sequences x(n) ={1,2,3,4} & h(n) ={1,3,5}, find the output sequence y(n) by using linear convolution and circular convolution	CO2-App	(16)
		Or		
	(b)	For the given sequences x(n) ={1,-2,0,3} & h(n) ={1,-1,2}, find the output sequence y(n) by using linear convolution and circular convolution	CO2-App	(16)
12.	(a)	Use the Bilinear transformation to convert the analog filter with system function H(S) = s+0.1/(s+0.1)2+9 into a digital IIR filters. Select T=0.1s and compare the location of the zeros in H(Z) with the locations of the zeros obtained by applying the impulse invariant method in the conversion.	CO4-App	(16)
		Or		
	(b)	Design a Chebyshev filter with a maximum pass band attenuation of 2.5db at Ωp=20 rad/sec and stop band attenuation of 30db at Ωs=50rad/sec. (Analog Type-1 filter)	CO4-App	(16)
13.	(a)	Design a linear phase FIR Low pass filter using rectangular window with cut off ωc = 0.2 π rad/sample by taking N=7 samples.	CO3-Ana	(16)
		Or		
	(b)	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?	CO3-Ana	(16)
14.	(a)	Explain the characteristics of limit cycle oscillation with respect to the system described by the difference equation: y(n) = 0.95 y(n-1) + x (n). Determine the dead band of the system when x(n)=0.875 for n=0, 0 for n≠0	CO2-App	(16)
		Or		
	(b)	Explain the characteristics of a limit cycle oscillation with respect to the system described by the difference equation $y(n) = 0.75\, y(n-1) + x(n)$ assume b=5 (including sign bit) Determine the dead band of the filter.	CO2-App	(16)

15. (a) With a neat functional block diagram, outline the architecture of TMS320C5X processor in detail. CO1-U (16)

Or

(b) List the addressing modes of TMS320C5X processor with relevant examples. CO1-U (16)