





- b) i) State and prove Sampling theorem for band limited signals. (10)
- ii) In an analog to digital converter, the required signal to quantization noise ratio is 90 dB. Assume that the analog signal is Gaussian with a variance  $\sigma_x^2$  and the maximum value of the input signal is  $X_{\max} = 3\sigma_x$ . What is the number of bits needed in the A/D converter. (4)

22. a) i) Determine the Z transform of  $x[n] = \left(\frac{1}{4}\right)^n u[n] + (3)^n u(-n-1)$ . Plot ROC and poles and zeroes in the z plane. (8)

- ii) Use Z transform to perform the convolution of the following sequences: (6)

$$h(n) = \begin{cases} \left(\frac{1}{2}\right)^n, & 0 \leq n \leq 2 \\ 0, & \text{elsewhere} \end{cases} \quad \text{and} \quad x(n) = \delta(n) + \delta(n-1) + 4\delta(n-2)$$

(OR)

- b) i) Determine the response of the system (8)

$$y(n) = \frac{5}{6}y(n-1) - \frac{1}{6}y(n-2) + x(n)$$

to the input  $x(n) = \delta(n) - \frac{1}{3}\delta(n-1)$ . Is the system stable?

- ii) Find the discrete time Fourier transform of the following signal (6)

$$x[n] = \left(\frac{1}{2}\right)^{|n|}$$

23. a) i) Using DFT and IDFT perform the circular convolution of the sequences: (8)

$$x_1[n] = [2, 1, 2, 1] \quad \text{and} \quad x_2[n] = [1, 2, 3, 4]$$

- ii) Assume that complex multiplication takes 1μsec and that the amount of time to compute a DFT is determined by the amount of time it takes to perform all multiplication. (6)

1. How much time is needed to compute 1024 point DFT directly?

2. How much time is needed if FFT is used?

(OR)

- b) i) Compute the 8 point DFT of the sequence (8)

$$x_1[n] = \left[ \frac{1}{2}, \frac{1}{2}, \frac{1}{2}, \frac{1}{2}, 0, 0, 0, 0 \right] \quad \text{using Radix 2 DIT-FFT algorithm.}$$

- ii) The sequence  $x(n) = 2\delta(n) + \delta(n-1) + \delta(n-3)$ .  $X(K)$  is the five point DFT of  $x(n)$ .  $Y(K) = X^2(K)$  The five point inverse DFT of  $Y(K)$  is  $y(n)$ . (6)

Without calculating DFT find the sequence y(n).

24. a) i) Design a linear phase FIR filter using window method to meet the following specification (10)

$$0.99 \leq |H(e^{j\omega})| \leq 1.01 \quad 0 \leq |\omega| \leq 0.3\pi$$

$$|H(e^{j\omega})| \leq 0.01 \quad 0.35\pi \leq |\omega| \leq \pi$$

- ii) Draw the linear phase direct form structure of the FIR filter having the transfer function (4)

$$H(Z) = 1 - \frac{1}{4}Z^{-1} + \frac{1}{2}Z^{-2} + \frac{1}{2}Z^{-3} - \frac{1}{4}Z^{-4} + Z^{-5}$$

(OR)

- b) i) A digital low pass filter is required to meet the following specifications: (8)

- Pass band ripples  $\leq 1$  dB
- Pass band edge = 4 KHz
- Stop-band attenuation  $\geq 40$ dB
- Stop band edge = 6KHz
- Sampling rate = 24 KHz

The filter is to be designed using bilinear transformation on an analog system function. Determine the order of the Butterworth and Chebyshev filter, to meet these specifications in the digital implementation.

- ii) Obtain parallel realization for the transfer function given below: (6)

$$H(z) = \frac{1 + \frac{1}{4}z^{-1}}{(1 + \frac{1}{2}z^{-1})(1 + \frac{1}{2}z^{-1} + \frac{1}{4}z^{-2})}$$

25. a) i) Explain the different graphical display comments used in MATLAB. (6)

Write a program to generate and plot the continuous time and discrete time exponential signals.

- ii) Write a MATLAB program to perform linear convolution of two sequence of length 4 using DFT and IDFT. (8)

(OR)

- b) With functional block diagram explain the architecture of TMS 320C54xx

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