



- Notes :
1. Due credit will be given to neatness and adequate dimensions.
  2. Assume suitable data wherever necessary.
  3. Diagrams and chemical equations should be given wherever necessary.
  4. Illustrate your answer necessary with the help of neat sketches.
  5. Use of pen Blue/Black ink/refill only for writing the answer book.

1. a) Determine the circular convolution of sequences, 7

$$x_1(n) = \left\{ \underset{\uparrow}{1}, 2, 3, 1 \right\},$$

$$x_2(n) = \left\{ \underset{\uparrow}{4}, 3, 2, 2 \right\},$$

Using the time domain formula.

- b) The first five points of the eight point DFT of a real valued sequence are,  $\{0.25, 0.125-j 0.3018, 0, 0.125-j 0.0518, 0\}$  Determine the remaining three points. 7

**OR**

2. a) A discrete time signal  $x(n)$  is defined as, 7

$$x(n) = \begin{cases} 1 + \frac{n}{3}, & -3 \leq n \leq -1 \\ 1 & 0 \leq n \leq 3 \\ 0 & \text{elsewhere} \end{cases}$$

I) Determine its values & sketch the signal  $x(n)$ .

II) Sketch the signal that results if we,

- i) First fold  $x(n)$  & then delay the resulting signal by four samples.
- ii) First delay  $x(n)$  by four samples & then fold the resulting signal.

- b) Show that the energy (Power) of a real valued energy (Power) signal is equal to the sum of the energies (Powers) of its even and odd components. 7

3. a) Determine all the FIR filter's which are specified by the lattice parameter's 6

$$k_1 = \frac{1}{2}, k_2 = 0.6, k_3 = 0.7 \quad \& \quad k_4 = \frac{1}{3}.$$

- b) Determine a direct form realization for the following linear phase filter. 7

$$h(n) = \left\{ \underset{\uparrow}{1}, 2, 3, 4, 3, 2, 1 \right\}$$

**OR**

4. a) Sketch the lattice Ladder structure for the system 6

$$H(z) = \frac{1 - 0.8z^{-1} + 0.15z^{-2}}{1 + 0.1z^{-1} - 0.72z^{-2}}.$$

- b) Consider a causal IIR system with system function, 7  

$$H(z) = \frac{1 + 2z^{-1} + 3z^{-2} + 2z^{-3}}{1 + 0.9z^{-1} - 0.8z^{-2} + 0.5z^{-3}}$$
 i) Determine the equivalent Lattice-Ladder structure.  
 ii) Check if the system is stable.
5. a) Compare between Butterworth filter & Chebyshev filter & write the steps to design an analog Chebyshev lowpass filter. 6  
 b) Apply linear transformation to  $H(s)$ , 7  

$$H(s) = \frac{2}{(s+1)(s+2)}$$
 with  $T = 1$  sec. & find  $H(z)$ .
- OR**
6. Design an FIR low pass filter satisfying the following specifications. 13  
 $\alpha_p \leq 0.1$  dB,  $\alpha_s \geq 44.0$  dB.  
 $\omega_p = 20$  rad/sec.,  $\omega_s = 30$  rad/sec.  
 $\omega_{sf} = 100$  rad/sec.
7. a) Explain Tukey & Blackman method for periodograms. 6  
 b) What are the performance characteristics of Non-Parametric power spectrum estimators. 7
- OR**
8. a) Explain why AR model is widely used in random signal processing. 6  
 b) The Bartlett method is used to estimate the power spectrum of a signal  $x(n)$  consisting of 2400 samples. 7  
 i) Determine the smallest record length of each segment that yields a frequency resolution of  $\Delta f = 0.07$ .  
 ii) Determine the Quality factor QB.
9. a) What is multirate sampling? Explain its importance. 7  
 b) For the system, 7  

$$H(z) = \frac{1}{1 - az^{-1}}$$
  
 Determine  $P_0(z)$  &  $P_1(z)$  for the two component decomposition.
- OR**
10. a) Explain in detail quadrature mirror filter bank. 7  
 b) Explain polyphase decomposition process. 7
11. a) Explain in detail any one architecture of TMS320C54XX/TMS320C67XX series DSP processor. 7  
 b) Explain in detail how special purpose DSP can be used for FFT implementation. 6
- OR**
12. Explain special purpose DSP processor in detail. 13

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