

Total Marks 80

(3 Hours)

**N.B:** 1) Question **number 1** is compulsory.2) Attempt **any three** out of remaining.3) Assume suitable data if **necessary** and justify the assumptions.4) Figures to the **right** indicate full marks.

- 1 a) State whether unit step sequence is energy or power signal. Calculate Corresponding energy or average power as the case may be. [05]
- b) Perform convolution operation between given function in time domain if [05]  
 $x(n) = \begin{cases} 2^{-n} & -2 \leq n \leq 2 \\ 0 & \text{otherwise} \end{cases}$  and  
 $h(n) = u(n+2) - u(n-2)$
- c) Find the auto-correlation of the causal sequence  $x(n) = \{2, 4, 6, 8\}$  [05]
- d) State the condition for stability of LTI system and determine for the given discrete time system [05]  
 $h(n) = (2)^n u(n) + (0.5)^n u(n)$  is stable or not.
- 2 a) Determine whether or not the following signals are periodic. If periodic specify its fundamental period. [10]  
 i)  $x_1(n) = \sin(0.2\pi n + 3)$   
 ii)  $x_2(n) = \sin(0.5\pi n) + 5\cos(0.25n)$
- b) i) If  $x(n) = \{3, 4, 0, 6\}$  Find DFT  $X[k]$  [10]  
 ii) Using results obtained in i) and not otherwise find DFT of following sequences  
 $x_1(n) = \{6, 3, 4, 0\}$
- 3 a) Check whether following systems are [10]  
 i) Static or Dynamic  
 ii) Linear or Nonlinear  
 iii) Shift variant or Shift invariant  
 iv) Causal or Noncausal  
 i)  $y(n) = n \cdot x^2(n)$   
 ii)  $y(n) = 3x(n) + 5$
- b) For  $x(n) = \{1, 2, -1, 5, 0, 4\}$ , Plot the following discrete time signals [10]  
 $\uparrow$   
 i)  $x(n+3)$   
 ii)  $x(-n-2)$   
 iii)  $x(n) \cdot u(n-1)$   
 iv)  $x(n-2) \cdot \delta(n-2)$   
 v)  $x(2n)$
- 4 a) Find the DFT of the 8 point causal sequence using radix 2 DIT-FFT [10]  
 $x(n) = \{2, 1, 2, 1, 1, 2, 1, 2\}$
- b) Find the circular convolution of following causal sequences in time domain [05]  
 $x_1(n) = \{1, 2, 5\}$  and  $x_2(n) = \{4, 7\}$   
 so that result of linear and circular convolution will be same.

- c) Compare 128 point DFT and Radix 2- DIT-FFT with respect to the number of complex additions and multiplications required. [05]
- 5 a) In a LTI system the input  $x(n)=\{1, 1, 3\}$  and impulse response is  $h(n)=\{2, 3\}$ . Determine the response of LTI system using radix-2 DIT-FFT method. [10]
- b) Consider the 8 point sequence defined as  $0 \leq n \leq 7$   
 $x(n)=\{1, 2, 3, 0, 1, 2, 5, 2\}$  with a 8 point DFT. Evaluate the following function  $X[k]$  without computing DFT  
 $\sum |X[k]|^2$  [05]
- c) Determine 4 point DFT and sketch the magnitude of DFT  $x(n)=\{1, 1, 0, 0\}$  [05]
- 6 a) Find Linear Convolution of following causal signals using overlap add method. [10]  
 $x(n)=\{1, 2, 0, 1, 2, 3, 1, 1, 2, 1, 0, 3\}$   
 $h(n)=\{2, 2, 1\}$
- b) Write a detailed note on speech recognition. [05]
- c) Compare Microprocessor with Digital Signal Processor. [05]

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