

(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.
 $x(n)=\{1, 2, 0, 1, 2, 3, 1, 1, 2, 1, 0, 3\}$
 $h(n)=\{2, 2, 1\}$ [10]
- b) Write a detailed note on speech recognition. [05]
- c) Compare Microprocessor with Digital Signal Processor. [05]
