

(3 hours)

Total Marks: 80

- N.B. 1. Question No. 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

- Q1 A Compare microprocessor with digital signal processor. 05
 B State whether $x[n] = \cos(3\pi n/4)$ is an energy or power signal with proper justification. 05
 C Find the cross correlation of two causal sequences $x[n] = \{2, 3, 1, 4\}$ and $y[n] = 3\delta(n-3) - 2\delta(n) + \delta(n-1) + 4\delta(n-2)$. 05
 D State BIBO stability criterion for LTI systems. Test the stability of the LTI systems, whose impulse response is: $h[n] = 0.2^n u[-n] + 3^n u[-n]$. 05
- Q2 A Check whether the system $y[n] = a^n u[n]$ is: 10
 i) Static or Dynamic
 ii) Linear or Non-linear
 iii) Causal or Non-Causal
 iv) Shift variant or Shift Invariant
- B Consider analog signal $x(t) = 2 \sin 80\pi t$. If the sampling frequency is 60 Hz, find the sampled version of discrete time signal $x[n]$ also find an alias frequency corresponding to $F_s = 60$ Hz. 10
- Q3 A Determine the output response of the LTI system using tabular method, whose input is: 10
 $x[n] = 1$; $n = 0, 1$
 $= 3$; $n = 2, 3$
 $= 0$; elsewhere
 and $h[n] = \delta[n] - 2\delta[n-1] + 3\delta[n-2] - 4\delta[n-3]$.
- B Compute DFT of sequence $x[n] = \{0, 2, 3, -1\}$. Sketch the magnitude and phase spectrum. 10
- Q4 A Explain the following properties of DFT : 10
 i) Periodicity
 ii) Linearity
 iii) Time Shift
 iv) Circular Convolution
 v) Time Reversal
- B Compute linear convolution of the causal sequences $x[n] = \{4, 4, 3, 3, 2, 2, 1, 1\}$ and $h[n] = \{-1, 1\}$ using overlap save method. 10

[TURN OVER]

- Q5 A In a LTI system the input $x[n] = \{1, 2, 1\}$ and impulse response is $h[n] = \{1, 3\}$. 10
 Determine the response of LTI system using radix-2 DIT FFT method.
- B Explain Parseval's energy theorem. 10
 If IDFT $\{X(k)\} = x[n] = \{2, 1, 2, 0\}$ using DFT properties, evaluate the following:
 i) IDFT of $\{X(k-1)\}$
 ii) IDFT of $\{X(k)$ circularly convolved with $X(k)\}$
 iii) IDFT of $\{X(k).X(k)\}$
 iv) Signal energy
- Q6 A Explain the significance of Carl's Correlation Coefficient Algorithm in digital 10
 signal processing. Evaluate Carl's Coefficient for two causal sequences
 $x[n] = \{3, 4, 7, 8\}$ and $y[n] = \{2, 1, 1, 2\}$.
- B i) Compare 64 point DFT and FFT systems with respect to the number of 5
 complex additions and multiplications required.
 ii) Write a detailed note on biomedical applications of DSP processors. 5