

(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 IIR systems with FIR systems. 05
 B State whether $x[n] = \sin(n\pi/3)$ is an energy or power signal with proper justification. 05
 C If $x[n] = \{1, 2, 2, 1, 3, 1\}$ is a periodic signal. Plot it in circular representation for
 i) $x[-n]$ ii) $x[n-2]$ iii) $x[n+2]$ iv) $x[-(n-2)]$ v) $x[-(n+2)]$ 05
 D State BIBO stability criterion for LTI systems. Determine the range of values of 'p' and 'q' for the stability of LTI system with impulse response:

$$h[n] = \begin{cases} p^n & ; n < 0 \\ q^n & ; n \geq 0 \end{cases}$$
- 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-Casual
 iv) Shift variant or Shift Invariant
- B Check the periodicity of the following signals and if periodic, find their fundamental period. 10
 i) $\cos(n/6) \cdot \cos(n\pi/6)$
 ii) $\sin(2\pi n/3) + \cos(2\pi n/5)$
- Q3 A Determine the output response of the LTI system using time domain method, whose input is $x[n] = 3\delta[n+1] - 2\delta[n] + \delta[n-1] + 4\delta[n-2]$ and $h[n] = 2\delta[n-1] + 5\delta[n-2] + 3\delta[n-3]$. 10
 B If a continuous time signal $x(t) = \sin(2\pi \times 2000t) + 2\sin(2\pi \times 1000t)$ is sampled at 8000 samples/sec. Find out the 4-point DFT of it. Sketch the phase and magnitude spectrum. 10
- Q4 A Explain any five properties of DFT. 10
 B Compute linear convolution of the causal sequences $x[n] = \{2, -3, 1, -4, 3, -2, 4, -1\}$ and $h[n] = \{2, -1\}$ using overlap save method. 10

[TURN OVER]

- Q5 A Compute circular convolution of the causal sequences $x[n] = \{1, -1, 1, -1\}$ and $h[n] = \{1, 2, 3, 4\}$ using radix-2 DIT FFT method. 10
- B If the DFT of $x[n]$ is $X(k) = \{2, -j3, 0, j3\}$ using DFT properties, find : 10
- DFT of $x[n-2]$
 - Signal energy
 - DFT of $x^*[n]$
 - DFT of $x^2[n]$
 - DFT of $x[-n]$
- Q6 A Explain the significance of Carl's Correlation Coefficient Algorithm in digital signal processing. Evaluate Carl's Coefficient for two causal sequences $x[n] = \{2, 4, 4, 8\}$ and $y[n] = \{1, 1, 2, 2\}$. 10
- B i) Calculate the percentage saving in calculations in a 64 point radix-2 FFT systems with respect to the number of complex additions and multiplications required, when compared to direct DFT system. 5
- B ii) Write a detailed note on DSP processor. 5