

(3 Hours)

[Total Marks :80

- N.B. : (1) Question No 1 is compulsory
(2) Attempt any three Questions out of remaining five questions.
(3) Assume suitable data wherever required and clearly specify it,
(4) Figures to the right indicate full marks.

1. (a) State the condition for stability of LTI system, determine the range of values of a and b for which the impulse time-invariant system with following given impulse response is stable. 5

$$h(n) = \begin{cases} a^n & n \leq 0 \\ b^n & n < 0 \end{cases}$$

- (b) Find the Energy of the signal $x(n) = 0.5^n u(n) + 8^n u(-n-1)$ 5
(c) Find the value of $x(n) = \cos(0.25 \pi n)$ for $n=0, 1, 2, 3$. Compute the DFT of $x(n)$ using FFT flow graph. 5
(d) Find the cross correlation of the sequences $x(n) = \{1, 2, 3, 4\}$ and $h(n) = \{2, 4, 6\}$ 5

2. (a) Determine whether or not the following signals are periodic. If periodic specify its fundamental period. 10

- (i) $x_1(n) = \cos(0.5 \pi n + 0.3)$
(ii) $x_2(n) = \cos(0.3 \pi n) + 10 \sin(0.25 \pi n)$

- (b) Compute Linear convolution of causal $x(n)$ and $h(n)$ using overlap add method in time domain 10

$$x(n) = \{1, 2, 3, 4, 5, 6, 7, 8\}, h(n) = \{1, 1, 1\}$$

3. (a) Check whether the given system $y(n) = x(2n) - x(n-1)$ is : 10
(i) Static or Dynamic (ii) Linear or non-linear
(iii) Shift invariant or variant (iv) Causal or non-causal
(v) Stable or unstable.

- (b) State the following DFT properties : 10
(i) Linearity property
(ii) Periodicity
(iii) Time shift
(iv) Convolution
(v) Time Reversal

[TURN OVER]

4. (a) For the causal LTI digital filter with impulse response given by $h(n) = 0.3 \delta(n) - \delta(n-1) + 0.38 \delta(n-3)$ sketch the magnitude spectrum of the filter. Using DFT. 10
- (b) Let $X(K) = \{20, 0, -4+4j, 0, -4\}$ is the 8 point DFT of a real valued sequence $x(n)$ 10
- (i) Find $X(K)$ for $K=5, 6, 7$.
- (ii) Find the 8 point DFT $P(K)$ such that $p(n) = (-1)^n x(n)$ Using DFT property.
5. (a) Find circular convolution and linear using circular convolution for the following sequences $x_1(n) = \{1, 2, 3, 4\}$ and $x_2(n) = \{1, 2, 1, 2\}$. Using Time Domain formula method. 10
- (b) Derive radix 2 DIT FFT flow graph and find the DFT of the sequence $x(n) = \{0, 1, 2, 3\}$ 10
6. (a) Write a detailed note on DSP Processor. 10
- (b) Write a detailed note on Carls' Correlation Coefficient Algorithm. Justify the necessary of Algorithm by given suitable example.