(Time: 3 Hrs) **Total Marks: 80**

1. Question no. 1 is compulsory.
2. Attempt any three questions out of remaining questions.
3. Assumptions made should be clearly stated.

Q.1 Attempt all questions. **[20]**

(a) Write properties of DFT. Prove any two.

(b) Differentiate between minimum, maximum and mixed phase systems.

(c) State sampling theorem and state how aliasing error occurs.

(d) Show pole zero diagram of given the given transfer function.

$$h(n) = (0.5)^n \quad for \quad 0 \le n \le 7$$

Q. 2 (a) Check whether given signal is energy or power signal. $x(t) = 7\cos 20t + \frac{\Pi}{2}$ **[5]**

(b) Sketch the signal

(i) $x(t) = -u(t+3) + 2u(t+1) - 2u(t-1) + u(t-3)$ **[5]**

(ii) If $x(n) = 1 + \frac{n}{3} \quad -3 \le n \le -1$ **[5]**

$1 \quad 0 \le n \le 3$

0 **Otherwise**

Sketch (i) $x(n-1)$ **(ii)** $x(2n-2)$

(c) Perform circular convolution of the signals given below. **[5]**

$x_1(n) = \{2\ 1\ 2\ 1\}$, $x_1(n) = \{1\ 2\ 3\ 4\}$

Q.3 (a) Classify the following systems as linear, nonlinear, time-variant, time invariant, causal, non-causal, static, dynamic, stable and unstable. **[10]**

i) $y(n) = nx(n)$

ii) $y(t) = x(t^2)$

(b) Obtain the magnitude and phase response of the following system by analytical and geometric method and identify the type of the filter.

$h(n) = (1, \frac{1}{2})$ **[10]**

Q.4 (a) Determine the inverse Z transform of the function- **[10]**

$X(z) = \frac{1}{1-1.5z^{-1}+0.5z^{-2}}$

(i) ROC $|z| > 1$

(ii) ROC $|z| < 0.5$

(iii) ROC $0.5 < |z| < 1$

Sketch for all ROC

(b)Determine the response of LTI discrete time system governed by, $2y(n) + 3y(n-1) + y(n-2) = x(n) + x(n-1) - x(n-2)$. **Find the response of thesystem when initial conditions are given as** $y(-1) = 2$, **and** $y(-2) = -1$ **and unit step is applied at the input.** **[10]**

Q. 5 (a) Find the initial value and final value of

$$X(Z) = \frac{2z^{-1}}{1-1.8z^{-1}+0.8z^{-2}}$$ **[5]**

(b) Find x(n) considering all possible region of convergence where **[5]**

$$X(z) = \frac{10z}{(z-1)(z-2)}$$

(c) An LTI System is described by **[10]**

$$y(n) = x(n) + 0.8x(n-1) + 0.8x(n-2) - 0.49y(n-2)$$

Determine transfer function of the system and sketch poles and zeroes on the z plane.

Q.6 (a) Compute DFT of the 4 Point sequence of the following –

(i) $x(n) = \{0, 1, 2, 3\}$

(ii) $x(n) = \{1, 2, 3, 1\}$ **[10]**

(b) Using radix 2 DIT FFT algorithm compute 8 point DFT for the given sequence

$$x(n) = \{0,\ 1,\ 1,\ 1,\ 1,\ 1,\ 1,\ 1\}$$ **[10]**

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