

(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.

$$h(n) = (0.5)^n \quad \text{for } 0 \leq n \leq 7$$

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

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

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

$$\begin{matrix} 1 & 0 \leq n \leq 3 \\ 0 & \text{Otherwise} \end{matrix}$$

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

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

$$x_1(n) = \{2 \ 1 \ 2 \ 1\}, \quad x_2(n) = \{1 \ 2 \ 3 \ 4\}$$

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.

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

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

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

$$(i) \text{ ROC } |z| > 1$$

$$(ii) \text{ ROC } |z| < 0.5$$

$$(iii) \text{ ROC } 0.5 < |z| < 1$$

Sketch for all ROC

(b) Determine the response of LTI discrete time system governed by,

$$2y(n) + 3y(n-1) + y(n-2) = x(n) + x(n-1) - x(n-2). \text{ Find the response of the system when initial conditions are given as } y(-1) = 2, \text{ and } y(-2) = -1 \text{ and unit step is applied at the input.} \quad [10]$$

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

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

(b) Find $x(n)$ considering all possible region of convergence where

$$X(z) = \frac{10z}{(z-1)(z-2)} \quad [5]$$

(c) An LTI System is described by

$$y(n] = x(n] + 0.8x(n-1] + 0.8x(n-2] - 0.49y(n-2] \quad [10]$$

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]
