

- N.B. :** (1) Question No. 1 is **compulsory**.
 (2) Attempt any **four** questions out of remaining **six** questions.
 (3) Assume **suitable** data if **necessary**.

1. (a) What is ROC ? State various conditions of ROC. 4
 (b) Consider a system with impulse response $h(n) = 3^{-n} \cdot u(n)$. Determine whether the system is stable or not. 4
 (c) State and prove differentiation property of z-transform. 4
 (d) If $x(n) = \{1, 2, 3, 4\}$, then 4
 sketch (i) $x(-n + 3)$
 (ii) $x(n-3) \cdot \delta(n-3)$
 (e) Check whether following system's are linear, time-invariant, causal or not. 4
 (i) $y(n) = x(-n + 3)$
 (ii) $y(n) = e^{x(n)}$

2. (a) Determine the inverse z-transform of the following z-domain functions – 10

$$x(z) = \frac{3z^2 + 2z + 1}{z^2 - 3z + 2}$$

- (b) Determine the frequency response, magnitude response, phase response and time delay of the system given by D.E. 10

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

3. (a) Develop direct form-I and direct form-II (DF-I and DF-II) realization of D.E. 10

$$y(n) = b_0x(n) + b_1x(n-1) + b_2x(n-2) + b_3x(n-3) - a_1y(n-1) - a_2y(n-2) - a_3y(n-3)$$

- (b) Find the 4-pt DFT of the sequence $x(n) = \cos \frac{n\pi}{4}$. 10

4. (a) Find circular convolution using FFT/IFFT technique for : 10

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

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

- (b) Two sequences are given below :- 10

$$x_1(n) = \{1 + 5j, 2 + 6j, 3 + 7j, 4 + 8j\}$$

$$x_2(n) = \{6, 8, 10, 12\}$$

Find DFT of each sequence using DFT only once.

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5. (a) Realise the following impulse response using FIR linear phase structures – 8

$$h(n) = \delta(n) - \frac{1}{2}\delta(n-1) + \frac{1}{4}\delta(n-2) + \frac{1}{4}\delta(n-3) - \frac{1}{2}\delta(n-4) + \delta(n-5)$$

- (b) Show that zero of linear phase FIR filter occur at reciprocal locations. 7
 (c) State the relationship between z-transform to DTFT and DFT. 5

6. (a) If $x(n) = \delta(n) + \delta(n-1) + \delta(n-2)$
 (i) Find $x(e^{j\omega})$ 3
 (ii) Find $x(k)$, four pt · DFT 3
 (iii) Show that DFT is sampled version of $|x(e^{j\omega})|$ 4

- (b) Obtain initial and final value for the following :-

(i) $x(z) = \frac{z^2}{z^2 - 1.2z + 0.2}$ 5

(ii) $x(z) = \frac{2z^2 + 1}{z^2 - 0.5z - 0.5}$ 5

7. Write short notes on :- 20

- (a) Effects of finite word length
 (b) Difference between DSP processor and Microprocessor
 (c) Comparison between IIR and FIR system
 (d) Comparison of computational complexity of DFT and FFT.