

BT-6/M06

9055

Digital Signal Processing

Paper : ECT-306

Time : Three Hours]

[Maximum Marks : 75

Note :- Attempt any FIVE questions.

## SECTION-I

1. (a) Compute the z - Transform of

$$x(n) = a^{|n|} \sin \omega_0 n \quad , |a| < 1 \quad 8$$

- (b) A digital Filter is characterised by the transfer function

$$H(z) = \frac{1 + 2z^{-1} + 3z^{-2} + 2z^{-3}}{1 + 0.9z^{-1} - 0.8z^{-2} + 0.5z^{-3}}$$

Check the stability of the filter using Jury - Marden stability criteria.

7

2. (a) Determine 8-point DFT of the sequence

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

using DIF-FFT, radix-2, algorithm.

12

- (b) Explain in-bit place computation in context of FFT algorithms.3

## SECTION-II

3. (a) Consider an FIR lattice filter with coefficients
- $K_1 = 0.65$
- ,
- $K_2 = -0.34$
- , and
- $K_3 = 0.8$
- .

(i) Find its impulse response by tracing a unit impulse input through the lattice structure.

(ii) Draw the equivalent direct form structure. 10

- (b) Explain state - space structure. 5

4. Consider a causal IIR system with system function

$$H(z) = \frac{1 + 2z^{-1} + 3z^{-2} + 2z^{-3}}{1 + 0.9z^{-1} - 0.8z^{-2} + 0.5z^{-3}}$$

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Contd.

- (i) Determine the equivalent lattice-ladder structure. 15
- (ii) Check if the system is stable. 15

**SECTION-III**

- 5. (a) Show that FIR filters are always stable filters. 3
- (b) Design a 15 tap causal linear phase low pass FIR filter with cut-off frequency  $\frac{\pi}{4}$  using a rectangular window. 12
- 6. (a) Explain Windowing technique of FIR filter Design. What are the requirements for a proper window function. 8
- (b) Compare IIR and FIR filters. 3
- (c) Derive the conditions for linear phase for FIR filter transfer function. 4

**SECTION-IV**

- 7. Determine the system function  $H(z)$  of the lowest order Chebyshev digital filter that meets the following specifications :
  - (i) 0.75 dB ripple in the passband  $0 \leq |w| < 0.24\pi$
  - (ii) At least 50 dB attenuation in the stopband,  $0.35\pi \leq |w| \leq \pi$ .  
Use Bilinear transformation. 15
- 8. Explain Design of IIR filters in frequency domain. 15

**Compulsory question :**

- 9. Explain the following :
  - (a) Schur-Cohn Fujiwara stability criteria. 4
  - (b) Gibb's Oscillations. 3
  - (c) Frequency sampling structure 4
  - (d) Bilinear transformation. 4