

**BT-6/M06****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

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

- (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

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

- (i) Determine the equivalent lattice-ladder structure.

- (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 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  $0 \leq |w| \leq 0.24\pi$   
 (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

  
**VGYAN**.COM  
 POWER OF KNOWLEDGE

