

Duration: 3hrs

[Max Marks:80]

- N.B. : (1) Question No 1 is Compulsory.
 (2) Attempt any three questions out of the remaining five.
 (3) All questions carry equal marks.
 (4) Assume suitable data, if required and state it clearly.

1 Attempt any FOUR [20]

- a Find the DFT of $x[n]=\{5, 6, 7, 8\}$. Using answer and not otherwise find DFT of $x_1[n]=\{8, 5, 6, 7\}$.
- b Find the impulse response if the frequency response of the system is given as $H(e^{j\omega}) = e^{-j3\omega}(1 + 0.5 \cos \omega - 0.95 \cos 2\omega)$
- c Realize the linear phase FIR filter given as $h[n] = \{1, -0.5, 0, 0.5, -1\}$ using minimum number of multipliers.
- d For linear phase FIR filter, one of the zeros is at $0.2e^{j\frac{\pi}{3}}$. Find other compulsory zeros for Odd Symmetric FIR filter. Determine the transfer function.
- e Compare FIR filters with IIR filters

2 a Find the DFT of a real sequence $x[n] = \{1, -2, 3, 5, 1, 3, -4, 2\}$ using DIT FFT. [10]

b The second order IIR filter is defined as [10]

$$H(z) = \frac{1}{(1 - 0.95z^{-1} + 0.225z^{-2})}$$

Determine the shift of poles in direct form and cascade form realization if coefficients are represented by 3 bits.

3 a Determine the digital IIR digital filter from analog filter transfer function which [10]

is given as $H(s) = \frac{10}{(s^2 + 7s + 15)}$ with $T=0.02\text{sec}$. using impulse invariant transformation method.

b Find DFT of $x_1[n]=\{1, 4, 3, -2\}$ and $x_2[n]=\{1, -2, 4, 5\}$ using DIF FFT only [10]
 once.

- 4 a Design a digital filter with flat passband and flat stopband which satisfies [10]
following constraints using bilinear transformation method. Assume $T_s=0.1s$.
 $0.8 \leq |H(e^{j\omega})| \leq 1 \quad 0 \leq \omega \leq 0.25\pi$
 $|H(e^{j\omega})| \leq 0.2 \quad 0.65\pi \leq \omega \leq \pi$
- b Find the output of the system having impulse response $h[n]=\{2,1,2\}$ for input [10]
sequence $x[n]=\{1, -2, 4, 5, 3, 2, 2, 1, 5, 7, -3, -1, 4, 2\}$ using Overlap-save
Method (Assume $N=6$).
- 5 a Design a digital FIR filter using Hanning window for $M=7$ for given [10]
specifications.
$$H(e^{j\omega}) = \begin{cases} e^{-j3\omega} & ; \quad \frac{\pi}{8} \leq |\omega| \leq \frac{\pi}{4} \\ 0 & ; \quad \text{otherwise} \end{cases}$$
- b Realize the filter function by lattice realization structure. [10]
$$H(z) = 1 + \frac{3}{4}z^{-1} + \frac{1}{2}z^{-2} + \frac{1}{4}z^{-3}$$
- 6 a Explain group delay and phase delay. [6]
b Explain how DTSP is used in echo cancellation process. [7]
c Write a short note on Limit cycle oscillations [7]