05. 06. 2025

TE(ELEX.) | Sem-V | R-19 | 'C' Scheme

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 Compute IDFT for the given DFT X(k) = {2, 1+j, 0, 1-j}

b State and prove the circular time shift property of discrete time signal.

c Explain Decimation and Interpolation.

d Convert the following analog filter with system function $H(s) = \frac{1}{(s+2)(s+0.6)}$ into a digital filter by means of impulse invariant and BLT method.

e Compute the circular convolution of following discrete time signals $x_1(n) = \{1, 3, 5, 3\}$ and $x_2(n) = \{2, 3, 1, 1\}$

2 a Using DFT/IDFT method, find the response of the system with impulse response $h(n) = 5\delta(n) - 2\delta(n-1)$ if the input to the system is $x(n) = 3u(n) - 2u(n-2) - u(n-3)$ [10]

b Design a Butterworth digital IIR lowpass filter using Impulse Invariant transformation method for the following specifications. [10]
$0.707 \le |H(e^{jw})| \le 1.0$ for $0 \le w \le 0.3\pi$
$|H(e^{jw})| \le 0.2$ for $0.75 \le w \le \pi$, (T= 1sec)

3 a Draw architectural block diagram of DSP processor and explain functions of each block. [10]

b Design a lowpass FIR filter using Hamming window to meet the following specifications [10]

$H_d(w) = 1 \quad \pi/6 \le w \le \pi/6$
$= 0 \quad$ Otherwise

Use 10 tap filter and obtain impulse response of desired filter.

4 a Obtain the DFT of the sequence $x(n) = (\frac{1}{2}, \frac{1}{2}, \frac{1}{2}, \frac{1}{2}, 0, 0, 0, 0)$ using DIF FFT algorithm. [10]

b Describe any one application of DSP. [10]

5 a Find linear convolution using overlap-save method the following sequences: [10]
x[n] = {1, 2, -1, 2, 3, -2, -3, -1, 1, 1, 2, -1} and h[n] = {1, 2, 3}

b Determine impulse response h(n) of a filter having desired frequency response, [10]
$H_d(e^{jw}) = e^{-j(M-1)w/2} \quad 0 \le w \le \pi/2$
$= 0 \quad \pi/2 \le w \le \pi$, M=7, Use frequency sampling approach.

6 a A difference equation describing a filter is given below [10]
$y[n] - \frac{3}{4} y[n-1] + 1/8\, y[n-2] = x[n] + \frac{1}{2} x[n-1]$
Draw direct form-I and direct form-II realizations.

b Write a note on polyphase filters. [10]

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