13 NOV 2025 TE EXTC SEM-V C SCHEME DTSP QP CODE: 10096384

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 Differentiate between Butterworth and Chebyshev approximation. [5]

b Describe the Gibbs Phenomenon in FIR filter design, with plots. [5]

c Explain round off error and input quantization error [5]

d Explain frequency warping in bilinear transformation. [5]

e First five points of the eight-point DFT of a real valued sequence are [5]
X (k)= {0.3, -j0.5, 0.8+j0.8, 0.9-j2, 1+j3}. Determine the remaining points. State the property of DFT used here.

2 a Find the output y(n) of a filter whose impulse response is h(n)= {1,1,1} and input signal x(n)= {3, -1,0,1,3,2,0,1,2,1} using (i) overlap save method (ii) Overlap add method. [10]

b Design a high pass FIR filter by finding the filter coefficients for given specifications. Order of the filter is N=7. [10]

$$H(\omega) = 1 \; ; \quad \frac{-\pi}{3} \leq |\omega| \leq \pi$$
$$= 0 \; ; \quad |\omega| \leq \pi/3$$

3 a Compute the DFT of the sequence x(n) = {2,1,2,1,2,1,2,1} using DIT-FFT algorithm. [10]

b [i] The coefficients of a system defined by H(z) =1/ ((1-0.3 z^{-1})(1-0.65z^{-1})) are represented in a number system with a sign bit and 3 data bits using signed magnitude representation and rounding. Determine the new pole locations for cascade realization of first order system. [5]

[ii] Explain in detail about round off effects in digital filter. [5]

4 a Sketch the frequency response and identify the following filters based on their pass band: [10]
i). $h(n) = \left\{1, -\frac{1}{2}\right\}$ ii). $H(z) = \frac{Z^{-1}-a}{1-aZ^{-1}}$

b Obtain the cascade and parallel form realization of [10]
y(n)= -0.1y(n-1) +0.2y(n-2) +3x(n)+3.6x(n-1) +0.6x(n-2)

5 a Design a digital Butterworth low pass filter that satisfies the following constraint using IIM. Assume $T = 1\ sec$ [10]

$$0.707 \leq |H(w)| \leq 1 \quad ; \qquad for \quad 0 < \omega < 0.3\pi$$
$$|H(w)| \leq 0.2 \quad ; \qquad for \ 0.75\pi < \omega < \pi$$

b A digital filter is described by the following difference equation: [10]

$$y(n) = 0.7y(n-1) + 0.2x(n)$$

i) Determine the frequency at which $|H(\omega)| = \frac{1}{\sqrt{2}}$

ii) Identify the filter type based on pass band.

6 a An analog filter has transfer function [10]

$$H(s) = \frac{s + 0.1}{(s + 0.1)^2 + 9}$$

Determine the transfer function of digital filter using bilinear transformation. The digital filter should have specification $\omega_r = \frac{\pi}{4}$.

b Describe EEG and ECG signal analysis. [10]
