



10EE64

Sixth Semester B.E. Degree Examination, June/July 2019
Digital Signal Processing

Time: 3 hrs.

Max. Marks:100

**Note: Answer any FIVE full questions, selecting
at least TWO questions from each part.**

PART - A

- 1 a. Determine the 8 point DFT of the Signal $x(n) = \{1, 1, 1, 0, 0, 0, 0, 0\}$. Also sketch its magnitude and phase. (10 Marks)
- b. Given the periodic sequences $x(n) = \{1, 3, 5, 7\}$, $h(n) = \{2, 4, 6, 8\}$. Find their convolution using Stockman's method. (10 Marks)
- 2 a. The 5 samples of the 8 point DFT $X(K)$ are $X(0) = 0.25$, $X(1) = 0.125 - j 0.3018$, $X(6) = 0$, $X(4) = 0$, $X(5) = 0.125 - j 0.0518$. Determine the remaining samples. (04 Marks)
- b. Compute the N point DFT of $x(n) = a^n$ where $0 \leq n \leq N - 1$. Hence determine the value of DFT for $x(n) = 0.5^n u(n)$ $0 \leq n \leq 3$. (06 Marks)
- c. Determine the output of a linear FIR filter whose impulse response is $h(n) = \{1, 2, 3\}$ and input signal $x(n) = \{1, 2, 3, 4, 5, 6, 7, 8, 9\}$ using overlap save method. Use 5 point circular convolution in your approach. (10 Marks)
- 3 a. Develop decimation in Time FFT algorithm with all necessary steps and neat signal flow diagram used in computing N point DFT $X(K)$ of a N point sequence $x(n)$. (10 Marks)
- b. Determine the DFT of the given sequence $x(n) = \{2, 1, 4, 6, 5, 8, 3, 9\}$ by FFT algorithm which gives the output in bit reversal order. (10 Marks)
- 4 a. Find the Four point circular convolution of $x(n)$ and $h(n)$ using Radix x-2 DITFFT algorithm $x_1(n) = \{2, 1, 1, 2\}$ $h(n) = \{1, -1, -1, 1\}$. (10 Marks)
- b. Develop a radix - 3 DITFFT algorithm for evaluating the DFT for $N = 9$ which accepts bit reversal I/P. (10 Marks)

PART - B

- 5 a. Design a Digital Butterworth digital high pass filter with the following specifications.
 $|H(e^{j\omega})| \leq 0.2 \quad 0 \leq \omega \leq 0.2\pi \quad T = 1\text{Sec}$
 $0.8 \leq |H(e^{j\omega})| \leq 1 \quad 0.6\pi \leq \omega \leq \pi$
 Using Impulse Invariant method. (10 Marks)
- b. Convert the given analog transfer function into equivalent digital transfer function using bilinear transformation technique.
 $H(s) = \frac{1}{(s+1)(s+2)}$. Take $T = 1$ sample/Sec. (04 Marks)
- c. Determine the order of low pass filter if it has pass band attenuation of -3dB at 500Hz and stop band attenuation of -40dB at 1000Hz . (06 Marks)

- 6 a. Explain Impulse Invariant transformation technique. (10 Marks)
 b. Design Chebyshev high pass filter using bilinear transformation for the following specifications
 $\omega_p = 0.2\pi$ $\omega_s = 0.01\pi$
 $\alpha_p = -1\text{dB}$ $\alpha_s = -10\text{dB}$ (10 Marks)

- 7 a. Design an ideal low pass FIR filter whose desired frequency response is

$$H_d(e^{j\omega}) = \begin{cases} 1 & \frac{\pi}{3} \geq \omega \geq \frac{-\pi}{3} \\ 0 & \pi \geq |\omega| \geq \frac{\pi}{3} \end{cases}$$

Using Hamming window.

Determine the impulse response for $N = 9$.

(10 Marks)

- b. Design a high pass FIR filter whose desired frequency response is given by

$$H_d(e^{j\omega}) = \begin{cases} e^{-j\left(\frac{N-1}{2}\right)\omega} & \pi \geq |\omega| \geq \frac{\pi}{2} \\ 0 & \pi > |\omega| \geq 0 \end{cases}$$

For $N = 9$ using Frequency Sampling technique.

(10 Marks)

- 8 a. Obtain the direct form I, direct form II and parallel form realization for the transfer function. $H(z) = \frac{8z^3 - 4z^2 + 11z - 2}{\left(z - \frac{1}{4}\right)\left(z^2 - z + \frac{1}{2}\right)}$ (10 Marks)

- b. Realize the ladder structure for

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

(05 Marks)

- c. Realize the FIR filter having impulse response

$$h(n) = \delta(n) - \frac{1}{4}\delta(n-1) + \frac{1}{2}\delta(n-2) + \frac{1}{2}\delta(n-3) - \frac{1}{4}\delta(n-4) + \delta(n-5)$$

Use minimum number of multipliers.

(05 Marks)
