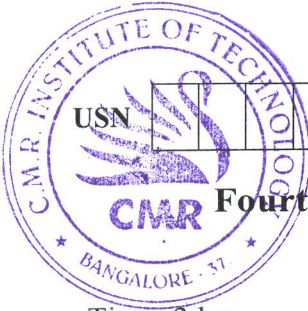


# CBCS SCHEME

21EC42



Fourth Semester B.E. Degree Examination, June/July 2023

## Digital Signal Processing

Time: 3 hrs.

Max. Marks: 100

Note: Answer any FIVE full questions, choosing ONE full question from each module.

### Module-1

- Define. DFT and IDFT and solve for the 4-point DFT of the sequence  $x(n) = [0, 1, 2, 3]$  and also write program to find N-point DFT. (10 Marks)
  - Explain the process of frequency domain sampling and reconstruction of discrete time signal. (10 Marks)

OR

- Summarize multiplication of two DFT properties and also write a program to verify Pasval's theorem. (08 Marks)
  - Make use of DFT and IDFT to compute circular convolution of the sequence.  $x(n) = [2, 3, 1, 1]$  and  $h(n) = [1, 3, 5, 3]$ . (08 Marks)
  - The five samples of 8-point DFT  $X(K)$  are given  $X(0) = 0.5$ ,  $X(1) = -j2$ ,  $X(4) = X(6) = 0$ .  $X(5) = +j2$ . Make use property to find remaining Samples and also find  $x(0)$ . (04 Marks)

### Module-2

- Explain the computational arrangement of 8-point DFT using Radix-2 DIT-FFT algorithm. (12 Marks)
  - Examine the o/p  $y(n) = x(n) * h(n)$  if  $x(n) = [1, 0]$  and  $h(n) = [1, 3, 1]$  using Radix-2 DIT-FFT algorithm. (08 Marks)

OR

- Examine the output of  $y(n)$  of a filter where impulse response  $h(n) = [3, 2, 1]$  input sequence  $x(n) = [2, 1, +1, -2, 3, 5, 6, -7, 2, 0, 2, 1]$ . Use 8-point circular convolution in your approach using overlap add method. (08 Marks)
  - Solve for 8-point DFT of the sequence  $x(n) = [1, 1, 1, 1]$  using Radix-2 DIT-FFT algorithm. (08 Marks)
  - What is the speed improvement factor in calculating 128 point DFT of sequence using direct computation and FFT algorithm? (04 Marks)

### Module-3

- What are the different design techniques are available for FIR filter? Explain the four window techniques for the designing of FIR filter. (08 Marks)
  - A low pass filter is to be designed with the following desired frequency response.

$$H_d(e^{j\omega}) = \begin{cases} e^{j3\omega} & \text{for } |\omega| \leq \frac{3\pi}{4} \\ 0 & \text{for otherwise} \end{cases}$$

Determine  $H(e^{j\omega})$  for  $M = 7$  using Hamming window. (08 Marks)

- Determine the direct form Relaziation of the following :

$$h(n) = \delta(n) + \frac{1}{2}\delta(n-1) - \frac{1}{4}\delta(n-2) + \frac{1}{2}\delta(n-3). \quad (04 Marks)$$

OR

- 6 a. Formulate the expression for symmetric FIR filter. (08 Marks)  
 b. Write a program and design for FIR Lowpass filter using humming window for  $M = 7$  and  
 $\omega_c = 3\pi/4$   $H_d(\omega) = \begin{cases} e^{-t3\omega} & \text{for } |\omega| \leq \omega_c \\ 0 & \text{for otherwise} \end{cases}$  (08 Marks)  
 c. Realize a linear phase FIR filter with following Impulse. Response  
 $H(z) = 1 + \frac{3}{4}z^{-1} + \frac{17}{8}z^{-2} + \frac{3}{4}z^{-3} + z^{-4}$  in cascade form. (04 Marks)

Module-4

- 7 a. Given that  $|H_a(\Omega)|^2 = \frac{1}{1+16\Omega^4}$ . Determine the Analog filter system function  $H_a(S)$ . (08 Marks)  
 b. Develop an analog filter with maximally flat response. In pass band with acceptable, attenuation of 2dB at 20rad/sec, the alteration in stop band more than that 10dB beyond 30rad/sec. (08 Marks)  
 c. Write program to implementation of IIR Butterworth Lowpass filter. (04 Marks)

OR

- 8 a. Realization of direct form – I and direct form – II of IIR filter is given by  
 $H(z) = \frac{3+4z}{z-\frac{1}{2}} - \frac{2}{z-\frac{1}{4}}$ . (06 Marks)  
 b. Make use of Bilinear transformation to obtain digital filter with  $\omega_r = \pi/2$  and  $\Omega = 4$  form  
 given analog filter  $H_a(s) = \frac{s+0.1}{(s+0.1)^2+16}$ . (08 Marks)  
 c. Write a program. Design and implementation of high pass filter to meet specification. (06 Marks)

Module-5

- 9 a. Describe the IEEE single precision floating point digital signal processors. (08 Marks)  
 b. Describe the digital signal processes following units :  
 i) Multiplier and accumulator  
 ii) Address generation unit. (08 Marks)  
 c. Determine following number into  $Q_{15}$  notation.  
 i) 0560123 ii) -0.160123. (04 Marks)

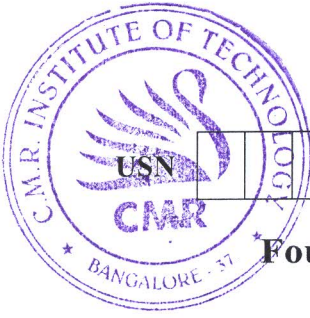
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OR

- 10 a. Explain fixed point digital signal processors of TMS320 family. (08 Marks)  
 b. Explain digital signal processor using Harvard architecture. (06 Marks)  
 c. Write a program for linear convolution of two sequences. Using DSK6713 DSP processor. (06 Marks)

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5/10/2023 9.30am



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### Fourth Semester B.E. Degree Examination, June/July 2023 Digital Signal Processing

- 5 b. A low pass filter is to be designed with the following desired frequency response,

$$H_d(e^{j\omega}) = \begin{cases} e^{-f3\omega} & \text{for } |\omega| \leq 3\pi/4 \\ 0 & \text{for otherwise} \end{cases}$$

Determine  $H(e^{j\omega})$  for  $M = 7$  using Hamming window.

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(08 Marks)

- 6 b Write a program and design for FIR Lowpass filter using Hamming window for  $M = 7$  and  $\omega_c = 3\pi/4$

$$H_d(\omega) = \begin{cases} e^{-f\omega\tau} & \text{for } |\omega| \leq \omega_c \\ 0 & \text{for otherwise} \end{cases}$$

(08 Marks)