Register No.: .... Name: ....

SAINTGITS COLLEGE OF ENGINEERING (AUTONOMOUS)

(AFFILIATED TO APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY, THIRUVANANTHAPURAM)

FIFTH SEMESTER B.TECH DEGREE EXAMINATION (R,S), DECEMBER 2023
ELECTRONICS AND COMMUNICATION ENGINEERING
(2020 SCHEME)

Course Code: **20ECT303**

Course Name: **Digital Signal Processing**

Max. Marks: **100** **Duration: 3 Hours**

PART A

(Answer all questions. Each question carries 3 marks)

1. Compute the N-point DFT of the signal $x(n)=a^n$ for $0<a<1$.
2. Give three applications of DSP.
3. What is meant by radix-2 FFT?
4. Draw the basic butterfly computation in the DIT-FFT algorithm.
5. Give any two properties of Butterworth low pass filter.
6. What is Gibb's phenomenon?
7. Mention the various basic structures for IIR systems.
8. Define multi rate digital signal processing?
9. What are the various factors which degrade the performance of digital filter implementation when finite word length is used?
10. Differentiate between fixed point and floating point representation of number system in DSP.

PART B

(Answer one full question from each module, each question carries 14marks)

MODULE I

11. a) Find the 4 point DFT of the sequence $x(n)=\cos(n\pi/4)$. (6)
    b) State any four properties of the Discrete Fourier Transform. (8)

OR

12. Using linear convolution find $y(n)=x(n)*h(n)$ for the sequences $x(n)= (1,2,-1,2,3,-2,-3,-1,1,1,2,-1)$ and $h(n) = (1,2)$. Compare the result by solving the problem using (i) overlap-save method (ii) overlap-add method. (14)

MODULE II

13. a) Compute the 8 point DFT of the given sequence using DIT FFT radix 2 algorithm. x(n)={1,2,3,4,4,3,2,1} (10)

b) Compute the 4-point inverse FFT {6,-2+j2, -2, -2-j2}. (4)

OR

14. Derive the butterfly diagram of 8 point radix-2 DIT-FFT algorithm and fully label it. (14)

MODULE III

15. The desired response of a low-pass filter is (14)

$$H_d(e^{j\omega}) = \begin{cases} e^{-j3\omega}, & -3\pi/4 \le \omega \le 3\pi/4 \\ 0, & 3\pi/4 < \omega < \pi \end{cases}$$

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

OR

16. Determine H(z) for a Butterworth filter that satisfying the following specification: (14)

$$0.9 \le |H(e^{jw})| \le 1, \quad 0 \le \omega \le \pi/2$$

$$|H(e^{jw})| \le 0.2, \quad 3\pi/4 < \omega < \pi$$

Assume T=1sec. Apply bilinear transformation method.

MODULE IV

17. Explain the sampling rate increase by an integer factor I and derive the input-output relationship in both time and frequency domains. (14)

OR

18. a) Obtain direct form and cascade form realization for the transfer function of a FIR system given by (7)

$$H(z) = \left(1 - \frac{1}{4}z^{-1} + \frac{3}{8}z^{-2}\right)\left(1 - \frac{1}{8}z^{-1} - \frac{1}{2}z^{-2}\right).$$

b) Obtain FIR linear phase and cascade realizations of the system function. (7)

$$H(z) = \left(1 + \frac{1}{2}z^{-1} + z^{-2}\right)\left(1 + \frac{1}{4}z^{-1} + z^{-2}\right)$$

MODULE V

19. Draw the internal architecture of TMS320C67xx and explain its operation of each functional block. (14)

OR

20. a) The output of an A/D converter is applied to a digital filter with the system function. $H(z) = \frac{0.5z}{z-0.5}$, Find the output noise power from the digital filter, when the input signal is quantized to have eight bits. (7)

b) Find the effect of coefficient quantization on pole locations of the given second order IIR system, when it is realized in direct form I and in cascade form. Assume a word length of 4 bits through truncation. $H_1(z) = \frac{1}{1-0.9z^{-1}+0.2z^{-2}}$. (7)

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