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B.Sc. DEGREE (C.B.C.S.S.) EXAMINATION, SEPTEMBER 2024

Sixth Semester

Core Course—DIGITAL SIGNAL PROCESSING

(For B.Sc. Electronics)

[Prior to 2013 Admissions]

Time : Three Hours   Maximum Weight : 25

Part A

Answer **all** *questions.*
Each bunch of **four** *questions carries a weight of* 1.

I.   1   If the average power of a signal is finite, then it is called :

   a) Energy signal.   b) Power signal.

   c) Periodic signal.   d) Aperiodic signal.

2   The transfer function of the LTI system is defined as ——————.

   a) The ratio of Z transform of output to Z transform of input.

   b) The ratio of Z transform of input to Z transform of output.

   c) The difference between Z transform of input and Z transform of output.

   d) The sum of Z transform of input and Z transform of output.

3   Z transform of an is ——————.

   a) $z/z - a$.   b) $z/z + a$.

   c) $a/z + a$.   d) $a/z - a$.

4   The Fourier transform of impulse response of a system is called ——————.

Turn over

1/4

II. 5 IIR system has ———————— memory of length ———————— samples.

    a) Infinite, N samples.   b) Infinite, infinite samples.

    c) Infinite, N – 1 samples.   d) Infinite, N + 1 samples.

6 The basic building blocks that can be interconnected to form block diagram or signal flow graph are ————————.

    a) Adder, constant multiplier and unit delay

    b) Adder, subtractor and multiplier

    c) Multiplier, constant divider and unit delay

    d) Adder, constant divider and unit delay

7 For a recursive system the output of the system is depends on ————————.

8 The N point DFT of a L point sequence will have a periodicity of ————————.

    a) N samples.   b) N + 1 samples.

    c) N – 1 samples.   d) N/2 samples.

III. 9 The convolution by FFT is called ————————.

    a) Circular convolution.   b) Linear convolution.

    c) Fast convolution.   d) Slow convolution.

10 Appending zeros to a sequence in order to increase its length is called ————————.

11 In DFT computation using radix 2 FFT, the value of N should be such that ————————.

    a) $N = 2^m$.   b) $N = m^2$.

    c) $N = 2(m - 1)$.   d) $N = m^{-1}$.

12 An N point sequence is called ———————— if it is antisymmetric about point zero on the circle.

    a) Even.   b) Odd.

    c) Aperiodic   d) Periodic.

IV. 13 In FIR filters with constant phase delay the impulse response is ——————.

   a) Symmetric.   b) Antisymmetric.

   c) Aperiodic.   d) Periodic.

14 The oscillations developed due to truncation of impulse response is called ——————.

15 In rectangular window the width of main lobe is equal to ——————.

   a) $4\pi/N$.   b) $8\pi/N$.

   c) $2\pi/N$.   d) π/N.

16 The impulse invariant mapping is —————— mapping whereas bilinear mapping is ——————.

   a) Many to one, one to one.

   b) One to many, one to one.

   c) Many to one, one to many.

   d) Many to many, one to one.

$(4 \times 1 = 4)$

Part B

Answer any **five** *questions.*
Each question carries a weight of 1.

17 Give any *two* applications of Fourier transform.

18 List any *four* properties of Fourier Transform.

19 Give the expression for the transfer function of IIR system.

20 Define IDFT.

21 What is the draw back in Fourier transform and how it is overcome ?

22 What do you meant by DIF radix 2 FFT ?

23 Write the properties of linear convolution.

24 What is impulse invariant transformation ?

$(5 \times 1 = 5)$

Turn over

Part C

*Answer any **four** questions.*
Each question carries a weight of 2.

25 What are the different classifications of discrete time systems ?

   Test the following systems foe time invariance :

   (a) $y(n) = nx(n)$; and

   (b) $y(n) = x(n) - bx(n-1)$.

26 What do you mean by Z transform ? Find the Z transform of $\sin\omega t$.

27 An LTI system is described by the difference equation $y(n) = a_1\,y(n-1) + x(n) + b_1\,x(n-1)$.

   Realize it in direct form I structure and convert to direct form II structure.

28 Why linear convolution is important in DSP ? Prove the commutative property of linear convolution.

29 Explain the properties of DFT.

30 Differentiate IIR and FIR filters.

$$(4 \times 2 = 8)$$

Part D

*Answer any **two** questions.*
Each question carries a weight of 4.

31 What are the properties of Z transform ? Explain any *five* properties. Find the inverse Z transform of the following function $X(z) = 1/\left(1 - 1.5z - 1 + 0.5z - 2\right)$.

32 Draw the direct form I, direct form II and parallel form realization of the following LTI system

   $$y(n) = -1/2\,y(n-1) + 2/8\,y(n-2) + 1/8\,y(n-3) + x(n) + 0.5\,x(n-1) + 0.75\,x(n-2).$$

33 An 8 point sequence is given by $x(n) = \{2, 2, 2, 2, 1, 1, 1, 1\}$. Compute 8 point DFT of x(n) by radix 2 DIT FFT.

$$(2 \times 4 = 8)$$