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B.Tech DEGREE EXAMINATION, NOVEMBER 2023

Seventh Semester

18ECE306J - ARM BASED DIGITAL SIGNAL PROCESSING

(For the candidates admitted during the academic year 2020 - 2021 & 2021 - 2022)

Note:

i. **Part - A** should be answered in OMR sheet within first 40 minutes and OMR sheet should be handed over to hall invigilator at the end of 40th minute.

ii. **Part - B** and **Part - C** should be answered in answer booklet.

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

PART - A (20 × 1 = 20 Marks) Marks BL CO

Answer **all** Questions

1. The time domain of time scaling is expressed as — Marks: 1, BL: 1, CO: 1
   (A) $tf(t)$ (B) $\frac{f(t)}{t}$
   (C) $f(at)$ (D) $sf(s) - f(0)$

2. What is the unit of angular frequency f — Marks: 1, BL: 1, CO: 1
   (A) rad/sec (B) samples/sec
   (C) rad/sample (D) sec/sample

3. Sampling frequency should be _____ than twice of angular frequency — Marks: 1, BL: 2, CO: 1
   (A) $2\pi f_s > 2\Omega_m$ (B) $2\pi f_s < 2\Omega_m$
   (C) $2\pi f_s \leq 2\Omega_m$ (D) $2\pi f_s \cong 2\Omega_m$

4. Discrete-time signals are _____ — Marks: 1, BL: 1, CO: 1
   (A) Continuous in amplitude and continuous in time (B) Continuous in amplitude and discrete in time
   (C) Discrete in amplitude and discrete in time (D) Discrete in amplitude and continuous in time

5. If we multiply $x[n]$ by an exponential signal, a^n, to obtain $x_2[n] = a^n x[n]$. The Z-transform of $x_2[n]$ — Marks: 1, BL: 3, CO: 2
   (A) $X(a^{-1}z)$ (B) $X(az)$
   (C) $X(z)$ (D) $X(a\,z^{-l})$

6. Utilizing the linear transformation evaluate 4-point DFT for $x(n) = \cos \pi n$ — Marks: 1, BL: 3, CO: 2
   (A) $X(K) = \{0, 1, 4, 0\}$ (B) $X(K) = \{1, 0, 4, 0\}$
   (C) $X(K) = \{0, 0, 4, 0\}$ (D) $X(K) = \{0, 0, 4, 1\}$

7. The Z-transform of the exponential signal is — Marks: 1, BL: 2, CO: 2
   (A) $\frac{z}{z-1}$ (B) $\frac{1}{1-az^{-1}}$
   (C) $\frac{1}{1-az}$ (D) $\frac{1}{1+az^{-1}}$

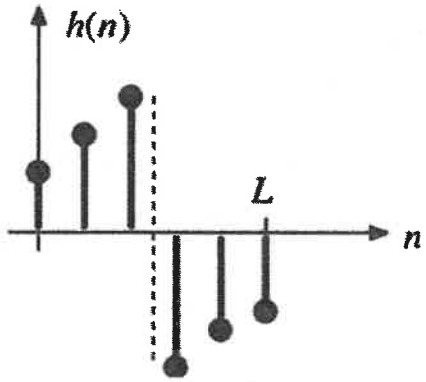
8. For direct evaluation of DFT, the number of complex multiplication required is equal to — Marks: 1, BL: 1, CO: 2
   (A) N^2 (B) $2N$
   (C) $4N$ (D) N^4

9. Finite Impulse Response of a filters _____ — Marks: 1, BL: 1, CO: 3
   (A) Are considered not recursive and cannot adopt feedback (B) Are considered as recursive and can adopt feedback
   (C) Utilize feedback only (D) Recursive

10. Raised-cosine window is also called as 1 2
(A) Raised cosine window (B) Blackman window
(C) Hamming window (D) Hanning window

11. Consider a system equation $y(n+2) = -3x(n+2) + 2x(n) - 5x(n-1)$, the system is _____ and _____ respectively 1 3 3
(A) Non-causal, IIR (B) Causal, IIR
(C) Non-causal, FIR (D) Causal, FIR

12. Identify the type of response of FIR filter below. 1 2 3



(A) Symmetric Odd (B) Symmetric Even
(C) Asymmetric Odd (D) Asymmetric Even

13. For an analog LTI system to be stable, where should the poles of system function H(s) lie? 1 2 4
(A) Right half of s-plane (B) Left half of s-plane
(C) On the imaginary axis (D) At origin

14. What is the condition on the system function of a linear phase filter? 1 3 4
(A) $H(Z) = Z^{-\mathbb{N}} H(Z^{-1})$ (B) $H(Z) = Z^{N} H(Z^{-1})$
(C) $+H(Z) = Z^{N} H(Z^{-1})$ (D) $+H(Z) = Z^{-N} H(Z^{-1})$

15. The Chebyshev filters have 1 2 4
1) Flat pass band 2) Flat stop band 3) Equi-ripple pass band 4) Tapering stop band
(A) 1 and 2 are correct (B) 2 and 4 are correct
(C) 2 and 3 are correct (D) All the four are correct

16. What is the Butterworth polynomial of order 1? 1 1 4
(A) $s-1$ (B) $s+1$
(C) s (D) $s(s+1)$

17. FIR filter implements _____ transfer function? 1 2 5
(A) Zero (B) Uni
(C) Bi (D) Multi

18. _____is a type of gradient descent which processes 1 training example per iteration. 1 1 5
(A) Batch Gradient Descent (B) Stochastic Gradient Descent
(C) Mini Batch gradient descent (D) Least Mean Square

19. Which of the following is the formula of symmetric impulse response of FIR filter? 1 2 5
(A) $h(n) = h(N-1-n)$ (B) $h(n) = -h(N-1-n)$
(C) $h(n) = h(N-1+n)$ (D) $h(n) = h\left(N - \frac{1}{(n)}\right)$

20. In cascade form of realization, how many bits should be used to represent the FIR filter coefficients in order to avoid the quantization effect on filter coefficients? 1 2 5
(A) 5 to 10 (B) 12 to 14
(C) 20 to 24 (D) 28 to 40

PART - B (5 × 4 = 20 Marks)

Answer **any 5** Questions

		Marks	BL	CO
21.	Define signal and describe exponential and sinusoidal discrete time signal with the condition and denote the graph.	4	1	1
22.	State and prove Linearity, time shifting property of Z-transform	4	1	2
23.	Explain the concept of Gibbs oscillation?	4	2	3
24.	List out the advantages and disadvantages of digital filters	4	2	4
25.	List out the applications of adaptive filter	4	1	5
26.	Determine the DFT for the sequence $x(n) = \{1, 1, 0, 0\}$	4	1	2
27.	List out any two types of window used to design FIR filters with their window sequence and frequency response equation.	4	2	3

PART - C (5 × 12 = 60 Marks)

Answer **all** Questions

		Marks	BL	CO
28.	(a) Discuss the properties of Discrete Time signals	12	2	1
	(OR)			
	(b) Describe in detail about Sampling theorem in time and frequency domain			
29.	(a) (i) Find Inverse Z-Transform using Long Division Method $H(z) = \frac{z-0.2}{z^2 - 0.5z + 0.5}$	12	3	2
	(ii) Find the circular convolution of two sequences $x(n) = 1, 2, 3, 4$ $y(n) = \{1, -1, 2, 1\}$			
	(OR)			
	(b) Solve 8-point DFT for the sequence $x(n) = \{2, 2, 2, 2, 1, 1, 1, 1\}$ using DIT-FFT algorithm.			
30.	(a) Explain the design of optimum-Equiripple Linear-phase FIR Filter.	12	3	3
	(OR)			
	(b) Design an ideal high-pass filter with frequency response using Hamming window $H_d(e^{j\omega}) = 1 \text{ for } \frac{\pi}{4} \leq \lvert\omega\rvert \leq \pi$ $0 \text{ for } \lvert\omega\rvert \leq \frac{\pi}{4}$			
31.	(a) Design a Chebyshev's filter with maximum half pass band attenuation of 2.5dB and 20rad/sec and stop band attenuation of 30dB at a frequency of 50rad/sec.	12	3	4
	(OR)			
	(b) Elaborate IIR filter design by impulse invariance			
32.	(a) Explain in detail about Prediction and System Identification	12	2	5
	(OR)			
	(b) Describe in detail about steepest descent method and Least Mean Square			

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