Reg. No ..... Name **24P355**

M. Sc. DEGREE END SEMESTER EXAMINATION - OCTOBER 2024

SEMESTER 3 : PHYSICS

COURSE : **21P3PHYT12 : DIGITAL SIGNAL PROCESSING**

(For Regular 2023 Admission and Supplementary 2022/ 2021 Admissions)

Duration : Three Hours Max. Weights: 30

PART A

Answer any 8 questions **Weight: 1**

1. What is meant by poles of a system function? (U, CO 3)
2. Represent the consequences of warping effect on amplitude and frequency response of analog and derived digital filter graphically. (U)
3. What is meant by zeros of a system function? (U, CO 3)
4. If $X(e^{j\omega})$ is the Fourier transform of x(n), find the Fourier transform of x*(-n). (An)
5. Explain the terms: passband, stopband and cut off frequency. (U)
6. Describe the complex exponential sequence. (U, CO 1)
7. Sketch the following signals (a) u(n+2) u(-n+3) and (b) x(n) = u (n+4) - u(n-2) (An, CO 1)
8. Outline the characteristics of IIR and FIR filters (An, CO 4)
9. Define the term 'linearity'. Illustrate with one example. (U, CO 1)
10. Find the system function and the impulse response of the system described by the difference equation y(n)=y(n-1)+2y(n-2)+x(n) (A, CO 2)

(1 x 8 = 8)

PART B

Answer any 6 questions **Weights: 2**

11. Show that FIR filters have constant phase delay and varying group delay if the impulse response is antisymmetrical about $\alpha = -(N-1)/2$. (An, CO 4)
12. Find DTFT of the following: i) δ(n) ii) u(n) iii) δ(n-2) ii) u(n-2) (E, CO 2)
13. Define sampling. State and establish Nyquist sampling theorm. Hence explain Aliasing. (U, CO 1)
14. Draw butterfly diagram and signal flow graph for N = 4. (A, CO 2)
15. Find the z-transform and ROC of the anticausal sequence x(n) = {3, 2, -1, 0, 1, 3} (E, CO 3)
16. Draw the block schematics of a digital signal processor. Explain each individual block in this processor. (A, CO 1)
17. Obtain H(z) for $H(s) = 2s/(s^2 + 0.2s + 1)$ when T = 1 s. (E, CO 4)
18. Check whether the following signals are energy signal or power signal i) x(n)= u(n+2)-u(n-2) ii) $x(n) = \cos(\omega_0 n)u(n)$ (E, CO 1)

(2 x 6 = 12)

PART C

Answer any 2 questions **Weights: 5**

19. Explain fast fourier transform and its advantages. Find the DFT of a sequence x(n) = {1,2,3,4,4,3,2,1} using DIT algorithm. (An, CO 2)
20. Discuss convolution and correlation of signals. Establish the properties of Cross correlation and Auto correlation of sequences. (U, CO 1)

21.	Discuss with necessary theory, the design of IIR filters using approximation of derivatives and impulse invariant techniques.	(An, CO 4)
22.	Explain the process of convolution and correlation of DT signals. Discuss the properties.	(An, CO 1)
		(5 x 2 = 10)

OBE: Questions to Course Outcome Mapping

CO	Course Outcome Description	CL	Questions	Total Wt.
CO 1	To understand the basic idea in signals both analog and digital, and various techniques in basic DSP process.	U	6, 7, 9, 13, 16, 18, 20, 22	19
CO 2	To understand the importance of transform in signal processing with special reference to DTFT and DFT	U	10, 12, 14, 19	10
CO 3	To correlate DTFT to Z transform and understand the concept of poles, zeros and stability in digital signal processing.	U	1, 3, 15	4
CO 4	To understand various filters and realization in digital systems.	A	8, 11, 17, 21	10

Cognitive Level (CL): Cr - CREATE; E - EVALUATE; An - ANALYZE; A - APPLY; U - UNDERSTAND; R - REMEMBER;