M. Sc. DEGREE END SEMESTER EXAMINATION - OCTOBER 2025
SEMESTER 3 : PHYSICS
COURSE : **24P3PHYT12EL : DIGITAL SIGNAL PROCESSING**
(For Regular - 2024 Admission)

Time : Three Hours   Max. Weights: 30

PART A
Answer any 8 questions   **Weight: 1**

1. Define transfer function? (R)
2. Give expressions for Z transform of right sided and left sided sequences. (U)
3. Give the basic expression representing convolution of two signals. Also, write three properties of linear convolution. (An)
4. What is FFT? (U)
5. Write a short note on correlation of two sequences. (R)
6. What is spectrum analyser? How is it different from a CRO? (An)
7. Express the given sequence $x(n) = \delta(n-1) + 2\delta(n-2) + 3\delta(n-3)$ in terms of unit step function. (An)
8. Describe graphically the behavior of low pass and high pass filter. (U, CO 3)
9. What is recursive and non-recursive system? Give example. (A)
10. What is meant by pole-zero system? (U)

(1 x 8 = 8)

PART B
Answer any 6 questions   **Weights: 2**

11. Describe the realization of IIR filter through Direct form structures. (An)
12. Find the ZT. of $x(n) = \cos(n\omega_0) u(n)$. (A)
13. Show that ZT of convolution of x(n) and h(n) is equal to X(z)H(z). (A)
14. Illustrate the properties of causality and time-variance with suitable examples. (U)
15. Given the specification $\alpha_p = 1dB$, $\alpha_s = 30$ dB, $\Omega_P = 200$ rad/s and $\Omega_s = 600$ rad/s, determine the order of the filter. (E)
16. Find the value of x(0) if X(z) is given by $(z^2+2z+2)/\{(z+1)(z+0.5)\}$ (A)
17. Compute the 4-point DFT of the sequences: a) x(n) = (0,1,-1,1)   b) x(n) = (-1,-1,2,-1) (E)
18. Sketch the continuous time signal $x(t) = 2 e^{-2t}$ for an interval $0 \le t \le 2$. Sample the continuous time signal with a sampling period T = 0.2 s and sketch the discrete-time signal. (An)

(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)
20. What are frequency selective filters? Explain various types of filters and their characteristics. Also, the advantages of digital filters. (An)

21. Explain LTI systems. Determine if the system described by the following input –output equations satisfy LTI nature or not. (i) y(n) = x(n) +1/{x(n-1)} (ii) y(n) = x^2(n) (iii) y(n) = n x(n). (iv) y(n)= 2x(n)+1/{x(n-1).

22. What do you understand by discrete time signal and discrete time system. Discuss the classification of discrete time systems.

(U)

(5 x 2 = 10)

OBE: Questions to Course Outcome Mapping

CO	Course Outcome Description	CL	Questions	Total Wt.
CO 3	Apply technique such as FFT for industry/research related problems	An	8	1

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