

M. Sc. DEGREE END SEMESTER EXAMINATION : NOVEMBER 2023**SEMESTER 3 : PHYSICS****COURSE : 21P3PHYT12(EL) : DIGITAL SIGNAL PROCESSING***(For Regular - 2022 Admission and Supplementary - 2021 Admission)*

Duration : Three Hours

Max. Weights: 30

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

1. Distinguish between discrete time and continuous time signals. (U, CO 1)
2. Explain what is meant by the frequency-response characteristic of a system. (An, CO 4)
3. What is the need of windowing techniques in FIR filter design? (A, CO 4)
4. Give the block schematics of an analog signal-processing set-up. (A, CO 1)
5. What is decimation in time FFT algorithm? (U, CO 2)
6. What is the DFT of a 2 sample sequence $x(n) = [A, B]$? (A, CO 2)
7. Name the technique used for the designing of IIR digital filters. State three essential steps involved in the derivation of digital filter transfer function. (U, CO 4)
8. Does the sum of two periodic signals be always periodic? Explain. (A, CO 1)
9. What is Z – transform? (R, CO 3)
10. What do you mean by transfer function of the system function? (A, CO 3)
(1 x 8 = 8)

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

11. Consider an analog signal $x(t) = 3 \cos(200\pi t)$. i) Determine the minimum sampling rate to avoid aliasing. ii) Suppose the signal is sampled at the rate $F_s = 150$ Hz, what is the discrete time signal obtained after sampling? (E, CO 1)
12. What are butterfly diagrams? How are they useful in the computation of FFT algorithms? Explain. (A, CO 2)
13. Find the digital network in direct and transposed form for the system described by the difference equation, $y(n) = x(n) + 0.5 x(n-1) + 0.4 x(n-2) - 0.6 y(n-1) - 0.7 y(n-2)$ (E, CO 4)
14. Test for time invariance of the system represented by (i) $y(n) = x(n+1) - x(n-1)$ and (ii) $y(n) = nx(n)$. (E, CO 1)
15. Describe the realization of FIR filter through cascade form structures. (A, CO 4)
16. What is ZT? Find the ZT: $x(n) = \cos n\theta u(n)$. (E, CO 3)
17. Calculate the percentage saving in calculations in a 512 – point radix – 2 FFT, when compared to direct DFT . (A, CO 2)
18. Draw the block schematics of a digital signal processor. Explain each individual block in this processor. (A, CO 1)
(2 x 6 = 12)

PART C**Answer any 2 questions****Weights: 5**

19. What is linear convolution? Explain three different methods to find convolution sum and hence convolve $x(n) = (0.9)^n u(n)$ with a ramp $h(n) = nu(n)$ using two methods. (Cr, CO 1)

20. Describe decimation in time FFT algorithm? Obtain the first step decimation in the time domain of the sequence: $x(n) = (1,2,3,4)$. (U, CO 2)
21. Discuss the realization of IIR digital filter using i) Direct form-I structure ii) Direct form-II structure and iii) cascade structure. (An, CO 4)
22. What is digital signal processing? Explain. Discuss with examples 4 different operations on signals. (U, 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	1, 4, 8, 11, 14, 18, 19, 22	19
CO 2	To understand the importance of transform in signal processing with special reference to DTFT and DFT	U	5, 6, 12, 17, 20	11
CO 3	To correlate DTFT to Z transform and understand the concept of poles, zeros and stability in digital signal processing.	U	9, 10, 16	4
CO 4	To understand various filters and realization in digital systems.	A	2, 3, 7, 13, 15, 21	12

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