Register No : ________________

THE KAVERY ENGINEERING COLLEGE

(An Autonomous Institution)

M.E DEGREE END SEMESTER THEORY EXAMINATIONS, NOV /DEC 2024

First Semester

Applied Electronics

PAPT2401 - Advanced Digital Signal Processing

Regulations - 2024

Duration : 3 Hrs *Maximum: 100 Marks*

*PART – A (ANSWER ALL QUESTIONS) (Marks 10*2=20)*

Q.No	*Questions*	*BLT*	*CO*	*Marks*
1.	What is aliasing in signal processing?	RE	1	2
2.	Differentiate low-pass and high-pass filters.	AP	1	2
3.	List the advantages of lattice structure	RE	2	2
4.	Distinguish between FIR and IIR filters.	AN	2	2
5.	Describe the key characteristic of an MA (Moving Average) model.	UN	3	2
6.	Summarize the significance of the reflection coefficients in the Burg method.	UN	3	2
7.	Outline the process of sampling rate conversion by a rational factor I/D.	UN	4	2
8.	Justify the need for up sampling and down sampling.	AN	4	2
9.	List two primary applications of narrow-band low-pass filters in digital signal processing.	RE	5	2
10.	List the main challenges when interfacing digital systems with different sampling rates.	AN	5	2

*PART – B (ANSWER ALL QUESTIONS) (Marks 5*13 = 65)*

Q.No			*Questions*	*BLT*	*CO*	*Marks*
11.	a	i	Discuss the importance of selecting the correct sampling frequency for digital signal processing.	UN	1	7
		ii	Explain the significance of the transfer function in signal processing.	UN	1	6
			Or			
	b	i	Explain how the FFT can be used to analyze the frequency response of a signal when passed through a low-pass filter.	UN	1	7
		ii	Illustrate how a 2D FFT is applied in image compression.	UN	1	6
12.	a	i	Analyze how a DCT algorithm is used for compressing a gray scale image.	AN	2	7
		ii	Compare Direct Form I and Direct Form II structures for implementing digital filters.	AN	2	6
			Or			
			Determine the lattice coefficients to the FIR filter with system function H(z) = $1+\frac{13}{24}z^{-1}+\frac{5}{8}z^{-2}+\frac{1}{3}z^{-3}$ and sketch the lattice structure.	AN	2	13

13.	a	i	Explain the Welch method for spectral estimation.	UN	3	7
		ii	Interpret the process of estimating power spectra using ARMA models.	UN	3	6
			Or			
	b	i	Summarize the properties of autocorrelation function of digital signals.	UN	3	7
		ii	Outline the Blackman-Tukey method for spectral estimation.	UN	3	6
14.	a	i	A signal x(n) is given by x(n) = {0, 1, 2, 3, 4, 5, 6, 0, 1, 2, 3, ...} a) Obtain the decimated signal with a factor of 2. b) Obtain the interpolated signal with a factor of 2.	AN	4	7
		ii	Examine how all-pass filters can be used in up-sampling applications.	AN	4	6
			Or			
	b	i	Design a multistage implementation for a system that needs to up-sample a signal from 2 kHz to 32 kHz.	AN	4	7
		ii	List the challenges associated with up-sampling using an all-pass filter.	AN	4	6
15.	a	i	Explain the design of a phase shifter in DSP.	UN	5	7
		ii	Discuss the design considerations for a narrow-band low-pass filter and its applications.	UN	5	6
			Or			
	b	i	Explain how aliasing cancellation is achieved in quadrature mirror filter bank.	UN	5	7
		ii	Describe the purpose and benefits of oversampling in A/D and D/A conversion.	UN	5	6

*PART – C (Marks 1*15 = 15)*

Q.No			*Questions*	*BLT*	*CO*	*Marks*
16.	a	i	A signal with a sampling rate of 8 kHz needs to be converted to 6 kHz. Examine how this would be accomplished using sampling rate conversion by a rational factor 3/4.	AN	4	8
		ii	Analyze the method of decimation by a factor D with your own example.	AN	4	7
			Or			
	b	i	Design a forward prediction error filter using lattice structures.	CR	2	8
		ii	Estimate the output for a 3-tap FIR filter with input signal x[n]=[1,2,3] and coefficients h[n]=[0.2,0.5,0.3].	CR	2	7