Register No : ____________________

THE KAVERY ENGINEERING COLLEGE

(An Autonomous Institution)

B.E/B.TECH DEGREE END SEMESTER THEORY EXAMINATIONS, APRIL-MAY 2025

Fourth semester

Biomedical Engineering

BM3401 - Signal Processing

Regulations -2021

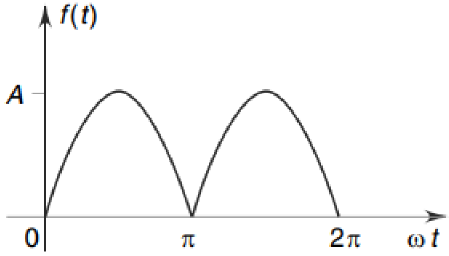
Duration : 3 Hrs ***Maximum : 100 Marks***

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

Q.No	Questions	BLT	CO	Marks
1.	Determine whether the following systems are static or dynamic $y(t) = x(2t) + 2x(t)$.	L2	1	2
2.	Differentiate between causal and non-causal signal.	L2	1	2
3.	State the necessary and sufficient conditions for the existence of the Fourier series representation for a signal.	L2	2	2
4.	Describe the relationship between DTFT and z-transform.	L2	2	2
5.	What are 'twiddle factors' of the DFT?	L1	3	2
6.	Explain the overlap-add method in linear convolution.	L2	3	2
7.	Summarize the advantages and disadvantages of FIR and IIR filters.	L2	4	2
8.	Discuss the characteristics of Chebyshev filters.	L2	4	2
9.	Explain the concept of Interpolation in multirate signal processing.	L2	5	2
10.	What is a linear phase FIR filter? Highlight its importance in digital signal processing.	L2	5	2

*PART – B (ANSWER ALL QUESTIONS) (Marks 5*16 = 80)*

Q.No			Questions	BLT	CO	Marks
11.	a	i	Determine whether the signals are energy or power signal $x(t) = e^{-3t}u(t)$.	L3	1	8
		ii	Explain different classifications of systems based on their properties.	L2	1	8
			Or			
	b	i	Determine whether the system $y(n) = sinx(n)$ is linear or nonlinear and static or dynamic.	L3	1	8
		ii	Illustrate with example, the aliasing effect in signal processing.	L2	1	8
12.	a		Obtain the Fourier series for the full wave rectified sine waves.	L4	2	16



			Or			
	b		Derive the DFT of the sample data sequence x(n) = {1, 1, 2, 2, 3, 3} and compute the corresponding amplitude and phase spectrum.	L4	2	16
13.	a	i	Determine the convolution of the two sequences x(n) = {2, 1, 0, 0.5} and h(n) = {2, 2, 1, 1}.	L3	3	8
		ii	Find the linear convolution through circular convolution of $x_1(n) = \delta(n) + \delta(n-1) + \delta(n-2)$ $x_2(n) = 2\delta(n) - \delta(n-1) + 2\delta(n-2)$	L3	3	8
			Or			
	b	i	Determine the 8-point DFT of the sequence. $x(n) = \begin{cases} 1, & -3 \le n \le 4 \\ 0, & \text{otherwise} \end{cases}$	L3	3	8
		ii	Summarize the computation efficiency of FFT over DFT.	L3	3	8
14.	a		Use bilinear transform to design a first-order Butterworth LPF with 3 dB cut-off frequency of 0.2 π.	L3	4	16
			Or			
	b		Convert the analog filter to digital filter whose system function is $H(s) = \frac{36}{(s+0.1)^2 + 36}$ The digital filter should have a resonant frequency of $\omega_r = 0.2\pi$. Use impulse invariant mapping.	L3	4	16
15.	a		Derive the expression for the impulse response of a low-pass FIR filter using the frequency sampling method.	L2	5	16
			Or			
	b		Compare and contrast the characteristics of FIR and IIR filters in terms of stability, complexity, and computational efficiency.	L2	5	16