Register No : _____

THE KAVERY ENGINEERING COLLEGE

(An Autonomous Institution)

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

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.	Sketch the continuous time signal x(t) = 2 e^{-2t} for an interval $0 \leq t \leq 2$.	AP	1	2
2.	Define linear system.	UN	1	2
3.	Write the equations for trigonometric & exponential Fourier series.	RE	2	2
4.	Obtain the Fourier transform of $x(t)=e^{-at}u(t)$.	UN	2	2
5.	Sketch and express the basic butterfly flow graph for the computation in the DIT FFT.	AP	3	2
6.	Compare DFT with DTFT.	EV	3	2
7.	Generalize the comment on the passband and stopband characteristics of butter worth filter.	AN	4	2
8.	Using backward difference for the derivative and convert the analog filter into digital filter given $H(S)=1/(S^2+16)$.	EV	4	2
9.	Formulate the equation specifying hamming window.	AP	5	2
10.	Show the diagram of causal FIR filter structure for length M= 5.	AP	5	2

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

Q.No			*Questions*	*BLT*	*CO*	*Marks*
11.	a	i	Define energy and power signal, also examine whether the following signals are energy or power or neither energy nor power signals. i. $x(n)=(1/4)^n u(n)$ ii. $x(n)=\sin(\pi n/3)$ iii. $x(n)=u(n)$	RE	1	7
		ii	Describe the concept of quantization and quantization error.	UN	1	6
			Or			
	b		A discrete system is characterized by the difference equation $y(n)=x(n)-0.5y(n-1)+0.25x(n-1)$. Evaluate the system for (i) Linearity (ii) Causality (iii) Time Invariant (iv) Static and (v) Stability	EV	1	13

12.	a	i	Find the Z transform and its ROC of X(n) = 2^n u(n) and X(n) = cos 3n u(n).	AP	2	7
		ii	State and prove convolution and Parseval's theorem using Z transform.	RE	2	6
			Or			
	b	i	Analyse the impulse response of the system described by the difference equation $y(n) = y(n-1) - \left[\frac{1}{2}\right] y(n-2) + x(n) + x(n-1)$ using Z transform and discuss its stability.	AN	2	7
		ii	Find the (i) linear convolution (ii) Circular Convolution of x(n)={2,1, 1, 2} with h(n)={1, -1, -1, 1}.	AN	2	6
13.	a	i	Given x(n) = n+1, and N=8, Evaluate X(K) using DIF FFT algorithm.	AN	3	7
		ii	Use 4-point inverse FFT for the DFT result {6,-2+2j,-2,- 2-2j} and evaluate the input sequence.	EV	3	6
			Or			
	b		Find the DFT of the sequence (i) x(n)={1,0,0,1} (ii) x(n)={1,-1,1,-1} using DIF algorithm.	AN	3	13
14.	a		Design a Chebyshev filter using impulse invariance method for the following specification 0.9 ≤ |Hejw| ≤ 1 0 ≤ w ≤ 0.25π |Hejw| ≤ 0.24 0.5 π ≤ w ≤ π	CR	4	13
			Or			
	b	i	If H(S)=1/(S+1)(S+2), Find H(z) using impulse invariant method for sampling frequency of 5 samples/sec.	EV	4	6
		ii	Realize the given transfer function H(Z)=(4Z^2+11Z-2)/(Z+1)(Z-3) using direct form-II and parallel structure.	CR	4	7
15.	a		Design a length-5 FIR band reject filter with a lower cutoff frequency of 2KHz, an upper cut-off frequency of 2.4KHz, and a sampling rate of 8000Hz using hamming window.	CR	5	13
			Or			
	b		Summarize the factors that decide the choice of window in FIR filter design using window techniques. Also compare the merits and demerits of windowing techniques.	CR	5	13

*PART – C (Marks 1*15 = 15)*

Q.No		*Questions*	*BLT*	*CO*	*Marks*
16.	a	Determine the DFT of the sequence x(n)={1,1,1,1,1,1,1,0} using DIT algorithm	AP	3	15
		Or			
	b	Obtain the inverse Z-transform of X(z)= $\{z^3+z^2\}$ / {(z-1)(z-3)} ROC |z|>3.	AP	2	15