

THE KAVERY ENGINEERING COLLEGE*(An Autonomous Institution)***B.E/B.TECH DEGREE END SEMESTER THEORY EXAMINATIONS, NOV/DEC 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)**

<i>Q.No</i>	<i>Questions</i>	<i>BLT</i>	<i>CO</i>	<i>Marks</i>
1.	Check whether the signal $x(t) = e^{-3t}u(t)$ is energy or not.	L3	1	2
2.	Given a continuous-time signal $x(t)=2\cos 500\pi t$. What is the Nyquist rate and fundamental frequency of the signal?	L4	1	2
3.	Find the Fourier transform of $x(t) = t.e^{-at}u(t)$.	L3	2	2
4.	What are the properties of Z transform?	L1	2	2
5.	Determine inverse Discrete Time Fourier Transform of $X(K)=\{1,0,1,0\}$.	L3	3	2
6.	How linear filtering is done using FFT?	L2	3	2
7.	Can IIR filter be designed without analog filters?	L2	4	2
8.	Where the $j\Omega$ axis of s-plane is mapped in z-plane bilinear transformation?	L2	4	2
9.	Mention the features of DSP processor.	L1	5	2
10.	Compare IIR and FIR.	L2	5	2

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

<i>Q.No</i>	<i>Questions</i>	<i>BLT</i>	<i>CO</i>	<i>Marks</i>
11.	a Check whether the following systems are static/dynamic, causal/non-causal, linear/non-linear, time invariant/time variant, stable/unstable: i. $y(n) = x(n).x(n-1)$ ii. $y(t) = x^2(t)$ iii. $y(t) = x(t).cost$ Or b i Determine whether the given signals are energy or power & Find its value. $x(t) = e^{-3t}u(t)$ & $x(t) = A \text{ rect}(t/T_0)$. ii Develop a quantization scheme that minimizes quantization error while maintaining a low bit rate.	L3	1	16
12.	a Consider causal and stable LTI system whose I/Ps and O/Ps are related through second order difference equation $y(n)-(1/6)y(n-1)-(1/6)y(n-2) = x(n)$ then determine system impulse response $h(n)$ for the system. Or	L3	2	16

	b	i	Find the inverse Laplace transform of $X(s) = \frac{1}{(s+5)(s-3)}$ if the ROC is, i. $-5 < \text{Re}(s) < 3$ ii. $\text{Re}(s) > 3$	L3	2	8
		ii	Compute IDFT of the sequence $x(n) = \{7, -0.707-j0.707, -j, 0.707-j0.707, 1, 0.707+j0.707, j, -0.707+j0.707\}$.	L3	2	8
13.	a	i	Find the linear convolution of $x(n)=\{2,4,6,8,10\}$ with $h(n)=\{1,3,5,7,9\}$.	L3	3	8
		ii	Differentiate overlap-add and overlap-save methods.	L3	3	8
	b	Or				
		i	Derive the decimation-in time radix-2 FFT algorithm and draw signal flow graph for 8- point sequence.	L3	3	8
14.	a	ii	Obtain the circular convolution of $x_1(n)=\{1, 2, 2, 1\}$ $x_2(n)=\{1, 2, 3, 1\}$.	L3	3	8
		Or				
	b	Explain how an analog filter maps into a digital filter in Impulse Invariant transformation.		L3	4	16
		Obtain cascade and parallel realization for the system having difference equation $y(n)+0.1y(n-1)-0.2y(n-2)=3x(n)+3.6x(n-1)+0.6x(n-2)$.		L3	4	16
15.	a	Design a length-5 FIR band reject filter with a lower cut-off frequency of 2KHz, an upper cut-off frequency of 2.4 KHz, and a sampling rate of 8000Hz using Hamming window.		L4	5	16
	Or					
	b	Explore the polyphase structure of decimator and interpolator with neat sketch.		L4	5	16