Register No : ________________

THE KAVERY ENGINEERING COLLEGE

(An Autonomous Institution)

B.E/B.TECH DEGREE END SEMESTER THEORY EXAMINATIONS, NOV/DEC 2025

Fourth Semester

Electronics and Communication Engineering

EC3492 – Digital 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.	Write down the equations for forward and inverse DFT.	L1	1	2
2.	Draw the basic butterfly structure of radix-2 2-point DFT computation using DIT-FFT and DIF-FFT.	L1	1	2
3.	Mention the properties of the Butterworth filter.	L1	2	2
4.	State the advantages and disadvantages of bilinear transformation.	L2	2	2
5.	Compare FIR filter with IIR filter.	L2	3	2
6.	List out the desirable characteristics of the window function.	L1	3	2
7.	Compare the fixed point and floating-point arithmetic.	L2	4	2
8.	Express the fraction $-\frac{7}{32}$ in sign magnitude, 1's and 2's complement representation.	L3	4	2
9.	Why anti-aliasing filter is required?	L2	5	2
10.	Draw the block diagram of sampling rate conversion by a factor I / D.	L1	5	2

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

Q.No		Questions	BLT	CO	Marks
11.	a	Find the output y(n) of a filter, the input is given by $x(n) = \{3,-1,0,1,3,2,0,1,2,1\}$ and $h(n) = \{1,1,1\}$ using overlap add method and overlap save method.	L3	1	16
		Or			
	b	Compute the eight point DFT of the sequence $x(n) = \{1,2,3,4,4,3,2,1\}$ using radix-2 DIT-FFT algorithm.	L3	1	16
12.	a	Design a digital Butterworth LPF to satisfy the constrains: $\frac{1}{\sqrt{2}} \le \lvert H(\omega) \rvert \le 1$ for $0 \le \omega \le \frac{\pi}{2}$; $\lvert H(\omega) \rvert \le 0.2$ for $\frac{3\pi}{4} \le \omega \le \pi$ using bilinear transformation with T=1 sec.	L4	2	16
		Or			
	b	Obtain the direct form-I, direct form-II, cascade, and parallel form realization for the system. $y(n) = -0.1y(n-1) + 0.2y(n-2) + 3x(n) + 3.6x(n-1) + 0.6x(n-2)$	L4	2	16

13.	a	Design a linear phase FIR filter with frequency response: $$H_d(e^{j\omega}) = \begin{cases} e^{-j3\omega} & \lvert\omega\rvert \le \frac{\pi}{4} \\ 0 & \frac{\pi}{4} \le \lvert\omega\rvert \le \pi \end{cases}$$ for N=7 using Hamming window.	L3	3	16
		Or			
	b	Determine the coefficients of a linear-phase FIR filter of length M=15 which has a symmetric unit sample response and a frequency response that satisfies the condition. $$H_r\left(\frac{2\pi k}{15}\right) = \begin{cases} 1, & k = 0,1,2,3 \\ 0.4, & k = 4 \\ 0, & k = 5,6,7 \end{cases}$$	L3	3	16
14.	a	Find the output round off noise power for the following transfer function $H(Z) = H_1(Z)H_2(Z)$, where $H_1(Z) = \frac{1}{1-a_1Z^{-1}}$ and $H_2(Z) = \frac{1}{1-a_2Z^{-1}}$ and $a_1 = 0.5$ and $a_2 = 0.6$. Calculate the value if b = 3 (excluding sign bit).	L4	4	16
		Or			
	b i	Consider the following transfer function: $$H(z) = \frac{1}{1-1.845z^{-1}+0.850586z^{-2}}$$ If the coefficients are quantized by truncation or rounding so that they can be expressed in 6-bit binary form in which 2-bits are used to represent integers (including sign bit) and four bits to represent fractions, find the pole positions for the cascade and direct forms with quantized coefficients.	L4	4	8
	ii	Explain the characteristics of limit cycle oscillation with respect to the system described by the difference equation: $$y(n) = 0.95\, y(n-1) + x(n);$$ $$x(n) = 0 \quad \text{and} \quad y(-1) = 13.$$ Determine the dead band range of the system.	L4	4	8
15.	a	Explain sampling rate conversion by a down sampling factor D and derive input-output relation in both time and frequency domain.	L2	5	16
		Or			
	b	Discuss in detail the applications of adaptive filtering with necessary diagrams.	L2	5	16