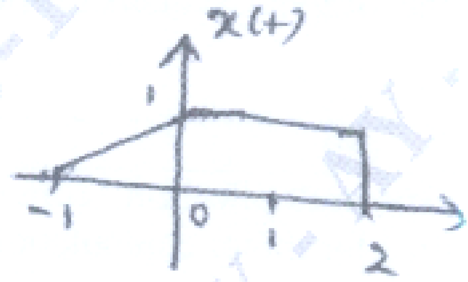
CBCS SCHEME

USN | | | | | | | | | | **BEE502**

Fifth Semester B.E./B.Tech. Degree Examination, Dec.2025/Jan.2026
Signals and DSP

Time: 3 hrs. Max. Marks: 100

Note: 1. Answer any FIVE full questions, choosing ONE full question from each module.
2. M : Marks , L: Bloom's level , C: Course outcomes.

		Module – 1	M	L	C
Q.1	a.	Explain the classification signals.	6	L2	CO1
	b.	For the signal x(t) shown in Fig.Q.1(b). Sketch the following: i) $y_1(t) = x(2t-3)$ and ii) $y_2(t) = x\dfrac{(-t+2)}{3}$  Fig.Q.1(b)	6	L3	CO1
	c.	Determine even and odd components of the following signals: i) $x(t) = (1+t^2-t)\sin 10t$ and ii) $x(n) = \{-1, \ 3, \ \underset{\uparrow}{1}, \ -4\}$	8	L3	CO1
		OR			
Q.2	a.	Determine whether it is periodic or not. If periodic find the fundamental period: i) $x(t) = 2\cos(3t + \pi/4)$ and ii) $x(n) = \cos(2\pi n)\sin(4\pi n)$	6	L3	CO1
	b.	Consider a discrete time system characterized by the following equation shows input output relationship. $y(n) = x(n-2) - 2x(n-17)$. Determine whether the system is i) Memory less ii) Time-invariant iii) Linear iv) Causal v) Stable.	6	L2	CO1
	c.	Find the convolution sum of two sequencing $x_1(n)$ and $x_2(n)$ as given below: $x_1(n) = \{1, \ \underset{\uparrow}{2}, \ 3, \ -4\}$ and $x_2(n) = \{1, \ \underset{\uparrow}{0}, \ -1, \ 3, \ 2\}$	8	L3	CO1
		Module – 2			
Q.3	a.	State and prove the following properties : i) Circular time shift ii) Parseval's theorem	8	L2	CO2
	b.	Compute the circular convolution using DFT and IDFT method. $y(n) = x_1(n) \circledast_N x_2(n)$, $x_1(n) = (1, 2, 3, 1)$ and $x_2(n) = (4, 3, 2, 2)$	12	L3	CO2

		OR			
Q.4	a.	Compute the IDFT of a 4-point sequence $X(k) = \{4,\ J2,\ 0,\ -J2\}$	8	L3	CO2
	b.	Consider a FIR filter with impulse response h(n) = (1, 2, -3) and input signal $x(n) = \{1,\ 2,\ 3,\ -3,\ -1,\ 4,\ -6,\ -2,\ 4,\ 3,\ 2,\ 1\}$. Find the output y(n). Use overlap save method and assume the length of block is 8.	12	L3	CO2
		Module – 3			
Q.5	a.	Develop the decimation in frequency algorithm for finding FFT. Draw the signal flow graph for N = 8.	10	L3	CO3
	b.	First five samples of 8-point DFT of real valued sequence is given by X(0) = 0, X(1) = 2 + J2, X(2) = -J4, X(3) = 2 – J2 and X(4) = 0. Determine remaining points, hence find the original sequence x(n) using DIT-FFT algorithm.	10	L3	CO3
		OR			
Q.6	a.	Tabulate the number of complex multiplication, complex additions and speed improvement factor required for direct computation of DFT and FFT for N = 32, 64, 128.	8	L3	CO3
	b.	Find the 8-point DFT of sequence $x(n) = \{1,\ 2,\ 3,\ 4,\ 4,\ 3,\ 2,\ 1\}$ using DIT-FFT radix-2 algorithm.	12	L3	CO3
		Module – 4			
Q.7	a.	List the merits and demerits of Digital filters.	8	L2	CO4
	b.	A discrete time system H(z) is expressed as $H(z) = \dfrac{10\left(1-\frac{1}{2}z^{-1}\right)\left(1-\frac{2}{3}z^{-1}\right)\left(1+2z^{-1}\right)}{\left(1-\frac{3}{4}z^{-1}\right)\left(1-\frac{1}{8}z^{-1}\right)\left(1-\left(\frac{1}{2}+J\frac{1}{2}\right)z^{-1}\right)\left(1-\left(\frac{1}{2}-J\frac{1}{2}\right)z^{-1}\right)}$ Obtain i) Cascade form realization and ii) Parallel realization	12	L3	CO4
		OR			
Q.8	a.	Design a digital filter to satisfy the following pass band ripple $1 \le H(J\Omega) \le 0$, for $0 \le \Omega \le 1404\pi$ rad/sec and stop band attenuation $\lvert H(\Omega)\rvert > 60dB$ for $\Omega > 8268\pi$ rad/sec sampling interval $T_s = \frac{1}{10^4}$ sec. Use BLT designing.	12	L3	CO4
	b.	Obtain the parallel realization for system described by $H(z) = \dfrac{\left(1+z^{-1}\right)\left(1+2z^{-1}\right)}{\left(1+\frac{1}{2}z^{-1}\right)\left(1-\frac{1}{4}z^{-1}\right)\left(1+\frac{1}{8}z^{-1}\right)}$	8	L3	CO4

		Module – 5			
Q.9	a.	List out difference between IIR and FIR.	4	L2	CO5
	b.	Realize the following : $H(z) = 1 + \frac{3}{4}z^{-1} + \frac{17}{8}z^{-2} + \frac{3}{4}z^{-3} + z^{-4}$ in i) Direct form ii) Cascade form realization	8	L3	CO5
	c.	The desired frequency response to the low pass filter is given by $H_a(e^{jw}) = H_a(w) = \begin{cases} e^{-J3w}\ ; & \lvert w \rvert < 3\pi/4 \\ 0\ ; & 3\pi/4 < \lvert w \rvert < \pi \end{cases}$ Determine the frequency response of FIR filter if the hamming window is used with N = 7.	8	L3	CO5
		OR			
Q.10	a.	The frequency response of filter is given by $H(w) = e^{-J3w}(1 + 1.8\cos 3w + 1.2\cos 2w + 0.5\cos w)$ Determine the coefficients of impulse response h(n) of the filter.	6	L3	CO5
	b.	Realize the linear in phase FIR having the following impulse response $h(n) = \delta(n) - \frac{1}{4}\delta(n-1) + \frac{1}{2}\delta(n-2) + \frac{1}{2}\delta(n-3) - \frac{1}{4}\delta(n-4) + \delta(n-5)$	6	L3	CO5
	c.	Realize the following impulse response in i) Direct form ii) Cascade form realization $H(z) = \left(1 - \frac{1}{4}z^{-1} + \frac{3}{8}z^{-2}\right)\left(1 - \frac{1}{8}z^{-1} - \frac{1}{2}z^{-2}\right)$	8	L3	CO5

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