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Fifth Semester B.E./B.Tech. Degree Examination, June/July 2026

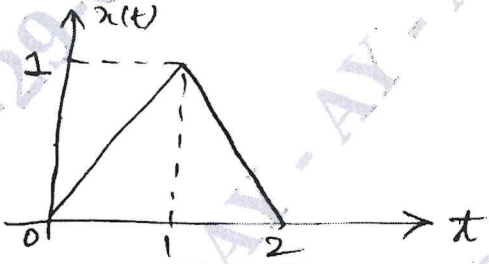
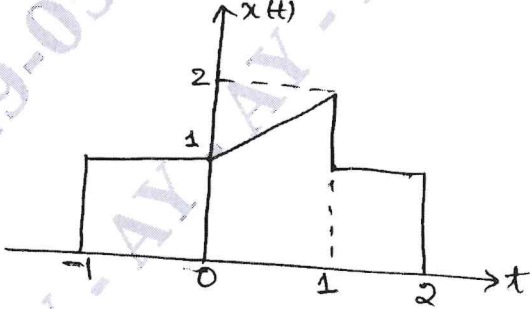
Signals and DSP



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.	Define signal? Discuss the classification of signals with examples.	8	L2	CO1
	b.	Determine and sketch the Odd and Even part of the signal shown in Fig.Q1(b) below.  Fig.Q1(b)	4	L3	CO1
	c.	Determine whether the given signals are periodic or non-periodic. If periodic determine its fundamental period i) $x(n) = \sin^2\left(\frac{\pi}{4} \times n\right)$ ii) $x(t) = \cos(2t) + \sin(3t)$.	8	L3	CO1
OR					
Q.2	a.	For the signal $x(t)$ shown in Fig.Q.2(a). Perform the following operations on the given signal. i) $x(t - 3)$ and $x(t + 3)$ ii) $x(2t + 2)$ and $x(t/2 - 2)$.  Fig.Q2(a)	8	L3	CO1
	b.	Determine whether the given signal is energy or power signals i) $x(t) = e^{-5t}u(t)$ ii) $x(t) = u(t) + u(t - 2)$.	8	L3	CO1
	c.	Discuss the properties of system.	4	L2	CO1

Module – 2

Q.3	a.	Determine the 8-point DFT of the sequence : $x(n) = \{1, 1, 1, 1\}$ For $N=8$. Also plot the Magnitude and phase plot of $X(K)$.	10	L3	CO2
	b.	State and prove the following properties of DFT. i) Circular time shift property ii) Linearity property.	6	L3	CO2
	c.	Define the IDFT of the sequence : $X(K) = \{3, 2 + j, 1, 2 - j\}$.	4	L3	CO2

OR

Q.4	a.	Perform the circular convolution of $x(n) = \{2, 1, 2, 1\}$ with $h(n) = \{1, 2, 3, 4\}$ by using DFT and IDFT method.	10	L3	CO2
	b.	Consider on FIR filter with impulse response $h(n) = \{3, 2, 1, 1\}$. If the input is given as $x(n) = \{1, 2, 3, 3, 2, 1, -1, -2, -3, 5, 6, -1, 2, 0, 2, 1\}$. Determine the output $y(n)$. Use overlap add method. Assume block length is 7.	10	L3	CO2

Module – 3

Q.5	a.	Define FFT algorithms? Discuss the advantages of FFT algorithms over the DFT.	6	L2	CO3
	b.	Discuss the differences between DIT FFT and DIF FFT algorithms.	4	L2	CO3
	c.	Determine the 8-point DFT of the sequence $x(n) = \{1, 2, 3, 4, 4, 3, 2, 1\}$ using DIT-FFT radix-2 algorithm.	10	L4	CO3

OR

Q.6	a.	Given $x(n) = (n+1)$ and $N=8$. Determine $X(K)$ by using DIF-FFT algorithm.	10	L3	CO3
	b.	Determine the circular convolution of $x(n)$ and $h(n)$ using DIF-FFT algorithm. Given : $x(n) = \{1, 1, 1, 1\}$ and $h(n) = \{1, 0, 1, 0\}$.	10	L3	CO3

Module – 4

Q.7	a.	Discuss the differences between IIR and FIR filters.	6	L2	CO4
	b.	Determine the digital system transfer function $H(z)$ for the given analog system by using impulse Invariant method. $H(S) = \frac{(S+0.1)}{(S+0.1)^2 + 3^2}$	8	L3	CO4
	c.	Draw the direct form – I and direct form – II realization for the given difference equation : $y(n) = \frac{-3}{8}y(n-1) + \frac{3}{32}y(n-2) + \frac{1}{64}y(n-3) + x(n) + 3x(n-1) + 2x(n-2)$	6	L3	CO4

OR

Q.8	a.	Design a Butterworth analog high pass filter that has the following specification. i) Maximum pass band attenuation = 2 dB ii) Passband edge frequency = 200 rad/sec iii) Minimum stop band attenuation = 20 dB iv) Stop band edge frequency = 100 rad/sec.	10	L3	CO4
	b.	Compare Butterworth and Chebyshev filter methods.	4	L2	CO4
	c.	Transform $H(s) = \frac{s+a}{(s+a)^2 + b^2}$ into digital filter using impulse invariant technique.	6	L3	CO4

Module – 5

Q.9	a.	Discuss the advantages and disadvantages of FIR filters.	6	L2	CO5
	b.	For the given FIR filter with the difference equation : $y(n) = x(n) + \frac{3}{4}x(n-1) + \frac{17}{8}x(n-2) + \frac{3}{4}x(n-3) + x(n-4)$ Draw the direct form – I.	6	L3	CO5
	c.	The frequency responses of an FIR filter is given by $H(\omega) = e^{j3\omega} (1 + 1.8 \cos 3\omega + 1.2 \cos 2\omega + 0.5 \cos \omega)$ Determine the coefficients of the impulse response $h(n)$ of the FIR filter.	8	L3	CO5

OR

Q.10	a.	Define window function. Discuss the classification of window function. Explain any four window functions with equations along with time domain and magnitude response curve.	10	L3	CO5
	b.	The desired frequency response of the low pass filter is given by $H_d(e^{jw}) = H_d(w) = \begin{cases} e^{-j3w}; & w < 3\pi/4 \\ 0; & 3\pi/4 < w < \pi \end{cases}$ Determine the frequency response of FIR filter if the hamming window is used, with $N = 7$.	10	L4	CO5