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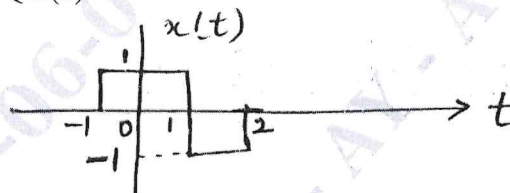
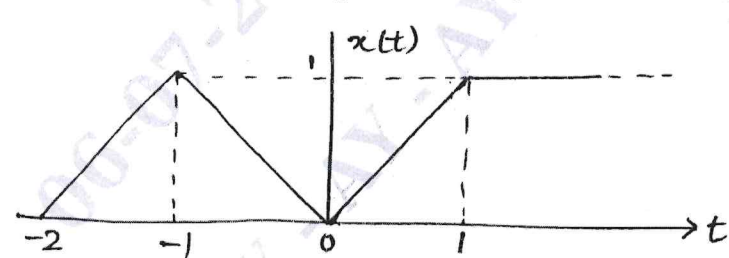
Third Semester B.E./B.Tech. Degree Examination, June/July 2026

Signals and Systems

Time: 3 hrs.

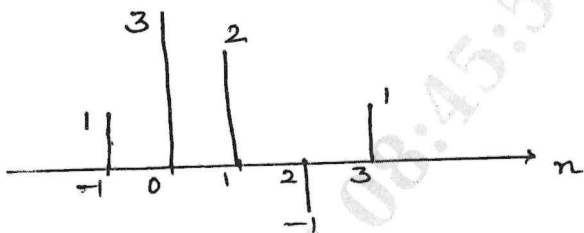
Max. Marks: 100

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.	Solve for odd and even components of the following signal: i) $x(t) = e^{-2t} \cos t$ ii) $x[n] = x^2 \left(\frac{1}{2}\right)^{x-2}$ As shown in Fig.Q.1(a)  Fig.Q.1(a)	10	L3	CO1
	b.	Identify whether or not each of the following signal is periodic or not. If periodic, find its fundamental period, i) $x(t) = \sin 4\pi t + \cos 2t$ ii) $x[n] = [-1]^n$	6	L3	CO1
	c.	Solve for total energy of the signal, $x[n] = n ; 0 \leq n \leq 5$ $10-n ; 5 < n \leq 10$ $0 ; \text{otherwise}$	4	L3	CO1
OR					
Q.2	a.	Solve and sketch the even and odd parts of the signal shown in Fig.Q.2(a)  Fig.Q.2(a)	5	L3	CO1
	b.	Construct the signal, $x(t) = -u(t + 3) + 2u(t + 1) - 2u(t - 1) + u(t - 3)$	5	L3	CO1
	c.	Identify whether the following system is linear, time invariant, memory, causal, stable, i) $y(t) = e^{x(t)}$ ii) $y(n) = x[-n]$	10	L3	CO1

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Module – 2

Q.3	a.	Construct and evaluate the convolution sum $y[n]$ by considering the input signal as $x[n] = 2\delta[n] - \delta[n-1]$ and an impulse response is as shown in Fig.Q.3(a)	10	L3	CO2
					
	b.	Solve for the convolution integral $y(t)$ for a continuous – time LTI system given by, $y(t) = u(t + 1) * u(t - 2)$	10	L3	CO2

OR

Q.4	a.	Construct and evaluate the convolution sum $y[n]$ by considering the input signal as $x[n] = \{1, 2, 3, 4\}$ and an impulse response $h[n] = \{5, 6, 7\}$	10	L3	CO2
	b.	Construct and evaluate the convolution integral $y(t)$ for a continuous-time LTI system given, unit impulse response $h(t) = e^{-t} u(t)$ and input to the system is $x(t) = e^{-3t} \{u(t) - u(t - 2)\}$	10	L3	CO2

Module – 3

Q.5	a.	Explain the following system properties in terms of impulse response of a discrete time LTI system: i) Memoryless system ii) Invertible systems and deconvolution.	6	L2	CO2
	b.	Find the natural response for the system described by the differential equation, $\frac{5dy(t)}{dt} + 10y(t) = 2x(t); y(0) = 3$	6	L3	CO2
	c.	Solve the following homogeneous differential equation with the initial conditions specified: $\frac{d^2y(t)}{dt^2} + 2\frac{dy(t)}{dt} + y(t) = 0$ with $y(0) = 1, y'(0) = 1$	8	L3	CO2

OR

Q.6	a.	Identify whether the following system characterized by impulse response is stable, causal, i) $h[n] = a^n u[n + 2]$ ii) $h[n] = 4^{-n} u[2-n]$ iii) $h[t] = e^{-t} u(t + 100)$	10	L3	CO2
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- b. Consider the interconnection of LTI systems depicted in Fig.Q.6(b). The impulse response of each system is given by,
 $h_1[n] = u[n]$, $h_2[n] = u[n+2] - u[n]$,
 $h_3[n] = \delta[n-2]$, $h_4[n] = \alpha^n u[n]$
 Find the impulse response of the overall system, $h[n]$

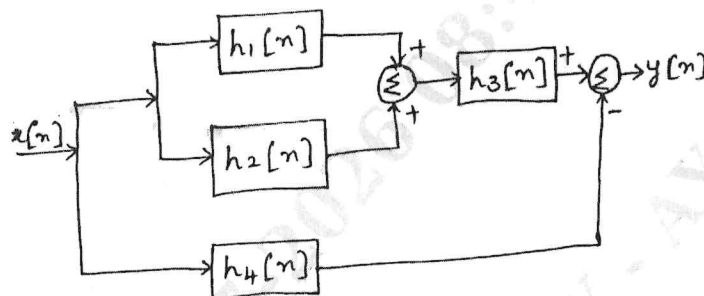


Fig.Q.6(b)

Module - 4

- Q.7 a. Apply Fourier series to find the FS coefficients for the signal $x(t)$ shown in Fig.Q.7(a).

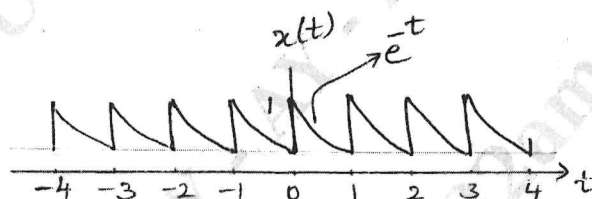


Fig.Q.7(a)

- b. Solve to determine the time signal corresponding to the magnitude and phase spectra shown in Fig.Q.7(b).

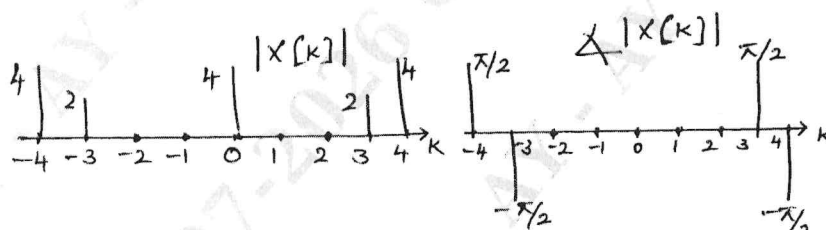


Fig.Q.7(b)

OR

- Q.8 a. Apply Fourier series to find the FS coefficients for the signal $x(t)$ shown in Fig.Q.8(a).

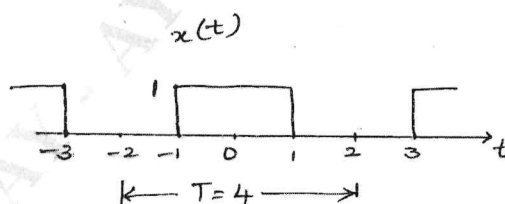


Fig.Q.8(a)

- b. Evaluate the discrete time Fourier series representation for the signal $x[n]$ shown in Fig.Q.8(b) and sketch the spectra. Also verify Parseval's identity.

10 L3 CO3

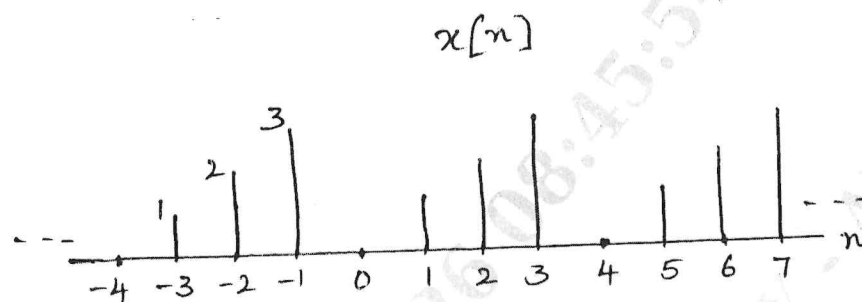


Fig.Q.8(b)

Module - 5

- Q.9 a. Solve for Fourier transform of the signal $x(t)$ using appropriate properties ,
 $x(t) = \frac{d}{dt}[t \cdot e^{-2t} \sin t \cdot u(t)]$

10 L3 CO4

- b. Solve for Fourier transform of the signal shown in Fig.Q.9(b) using time differentiation property.

10 L3 CO4

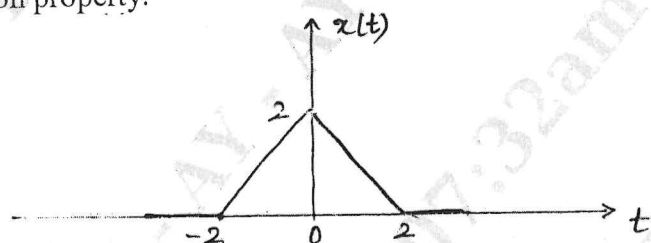


Fig.Q.9(b)

OR

- Q.10 a. Solve to determine the time-domain signal corresponding to the discrete time Fourier transform shown in Fig.Q.10(a).

10 L3 CO4

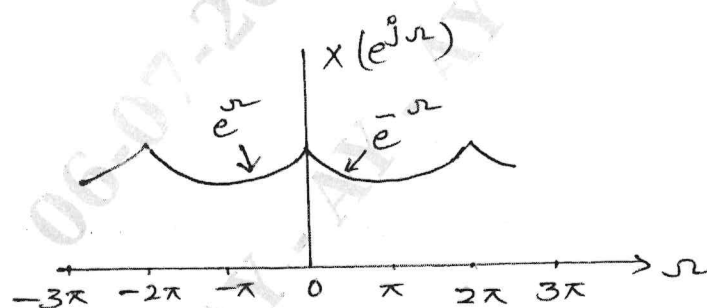


Fig.Q.10(a)

- b. Find the Fourier transform of $x(t) = e^{-a|t|}$; $a > 0$. Also draw its spectrum.

10 L3 CO4
