P.S.R. ENGINEERING COLLEGE

(An Autonomous Institution, Affiliated to Anna University, Chennai)
Approved by AICTE, New Delhi & Accredited by National Board of Accreditation (NBA)
Accredited by NAAC, Recognized under 12(B) of the UGC Act, 1956.
Sevalpatti (P.O), Sivakasi - 626140. Tamilnadu.

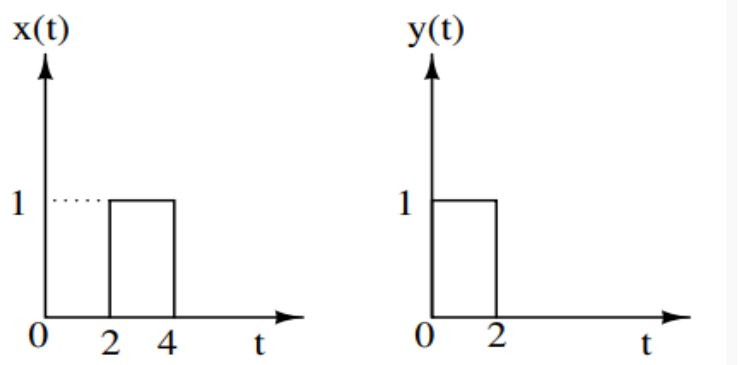
QUESTION BANK

Programme:	B.E.	Branch	Electronics and Communication Engineering
Acad. Year:	2024-25	Year/Semester	II Yr/IV Sem
Course Code:	231EC42	Course Name	**Signals and Systems**
Course Tutor:	Dr.K.Valarmathi,Prof/ECE & Mrs.P.Lingeswari/ECE		

UNIT-I CLASSIFICATION OF SIGNALS AND SYSTEMS

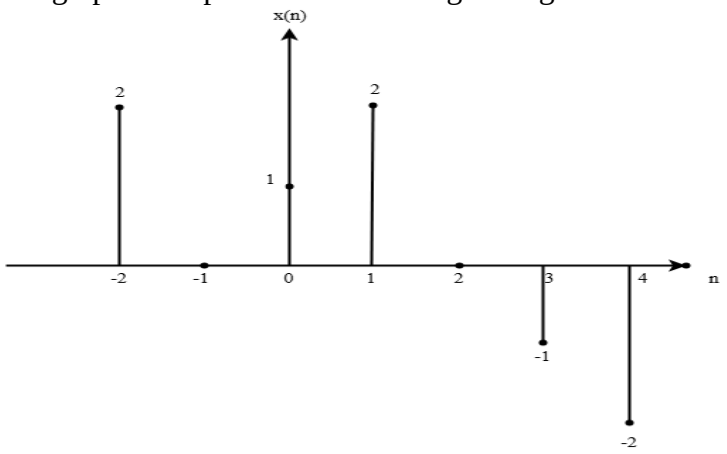
Part-A

S.No	Questions	Marks	BTL	COs
1.	cosh(x) is equal to _____ a) an odd signal b) an even signal c) cannot define d) a stochastic signal	1	K1	CO1
2.	The magnitude and phase of $3+3j$ are a)18, $-\frac{\pi}{4}$ b) 18, $\frac{\pi}{4}$ c) $3\sqrt{2}, -\frac{\pi}{4}$ d) $3\sqrt{2}, \frac{\pi}{4}$	1	K1	CO1
3.	An example of a random signal is _____ a) complex sinusoid b) exponential signal b) noise d) unit step	1	K1	CO1
4.	Let $\delta(t)$ denote the impulse function. Then, $\delta(at)$ equals a) $a\delta(t)$ b) $\lvert a\rvert\delta(t)$ c) $\frac{1}{a}\delta(t)$ d) $\frac{1}{\lvert a\rvert}\delta(t)$	1	K1	CO1
5.	The period of the discrete time signal, $\sin(\frac{6\pi n}{14})$ is: a)7 sec b) 14 sec c) 28 sec d) 42 sec	1	K1	CO1
6.	A linear time-invariant (LTI) system has to satisfy a) Only additivity and homogeneity properties b) Only homogeneity property c) Only additivity property d) Additivity, homogeneity and time-invariance properties	1	K1	CO1
7.	For the below figure, x(t) and y(t) are related as,	1	K1	CO1

	 a)y(t)=x(t-1) b)y(t)=x(t+2) c) y(t)=2x(t) d)y(t)=x(t-2)			
8.	The signal, $y(t) = A_1 \cos(\omega_1 t) + A_2 \cos(\omega_2 t)$ is periodic only when: a) $\frac{\omega_1}{\omega_2}$ is an irrational number b) $\frac{\omega_1}{\omega_2}$ is a rational number c) $\frac{\omega_1}{\omega_2}$ is an integer d) $\omega_1 + \omega_2$ is an irrational number	1	K1	CO1
9.	Consider a system with the following property. If input $x(t)$ yields output $y(t)$, then any input $x(t-t_0)$ yields output $y(t-t_0)$, where t_0 is any time-shift. This property is termed as a) Causality b) Homogeneity c) Additivity d) Time-invariance	1	K1	CO1
10.	When is a system said to be BIBO stable? a) When the boundary conditions of the system are stable b) When there is stability in the overall system c) Every Bounded input results in a bounded output d) When the input and output conditions are stable	1	K1	CO1
11.	Which one of the following systems is causal? a) y(t)=x(t)+ x(t-3) + x(t^2) b) y(n)=x(n+2) c) y(t)=x(t-1)+ x(t-2) d) y(n)=x($2n^2$)	1	K1	CO1
12.	y(t) = x (2t) is _____ a) compressed signal b) expanded signal c) shifted signal d) amplitude scaled signal by a factor of 2	1	K1	CO1
13.	When x(t) is said to be non-periodic signal? a) If the equation x (t) = x (t + T) is satisfied for all values of T b) If the equation x (t) = x (t + T) is satisfied for only one value of T c) If the equation x (t) = x (t + T) is satisfied for no values of T d) If the equation x (t) = x (t + T) is satisfied for only odd values of T	1	K1	CO1
14.	The step function u (t) is integral of _____ with respect to time t. a) Ramp function b) Impulse function c) Sinusoidal function d) Exponential function	1	K1	CO1
15.	For an energy signal _____ a) E=0 b) P= ∞ c) E= ∞ d) P=0	1	K1	CO1

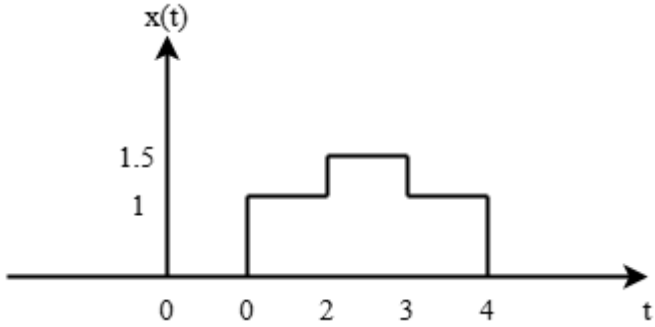
Part-B

S.No	Questions	Marks	BTL	COs
1.	Define unit step, ramp functions for CT.	2	K1	CO1

2.	How the unit step function and unit ramp can be obtained from a unit impulse function?	2	K1	CO1
3.	Define continuous and discrete time signal.	2	K1	CO1
4.	The graphical representation of a signal is given below.  Represent x(n) in terms of impulse functions.	2	K2	CO1
5.	Compare symmetric and asymmetric signal.	2	K2	CO1
6.	Define a linear system.	2	K1	CO1
7.	Outline the signal $u(n+4)-u(n-2)$.	2	K2	CO1
8.	Give the conditions for a system to be linear and time invariant.	2	K1	CO1
9.	What is the fundamental period of je^{j10t} ?	2	K1	CO1
10.	Find the power and RMS value of signal $x(t) = 20\cos 2\pi t$.	2	K1	CO1
11.	List any two properties of unit impulse function.	2	K1	CO1
12.	Outline the signal $x(t) = 2u(t) - u(t-3)$.	2	K2	CO1
13.	Define energy and power signal.	2	K1	CO1
14.	What are the conditions for a system to be LTI system?	2	K1	CO1
15.	Show whether the signal $x(t) = tu(t)$.	2	K2	CO1

Part-C

S.No	Questions	Marks	BTL	COs
1.	Classify the following signals: (i) Continuous time signal and discrete time signal (ii) Unit step and unit ramp function (iii) Periodic and aperiodic signal (iv) Deterministic and random signal	14	K2	CO1
2.	Explain all classification of systems with examples for each category.	14	K2	CO1
3.	Explain all classification of signals with examples for each category.	14	K2	CO1
4.	Classify whether the systems described by the following input-output equations are linear, dynamic, casual and time variant: i) $\frac{dy}{dt} + 3ty(t) = t^2 x(t)$ ii) $y(t) = tx(t) + bx^2(t)$	14	K2	CO1
5.	Classify the following systems under their linearity, time invariance and casual. (i) $y(n) = 2x(n+1) + 3$ (ii) $y(n) = 0.25x(n-1)$	14	K2	CO1

6.	i) For the signal x(t) shown in figure, outline $x(2-\frac{t}{2})$. ii) Outline the even and odd part of the signal x(t) shown in figure. 	14	K2	CO1
7.	i) Given $x(t)=\begin{cases}\frac{1}{6}(t+2); -2\le t\le 4\\ 0; otherwise\end{cases}$. Outline the signal (a) x(t) (b) x(2t) (c) x(2t+1) (d) x(t/2) .	7	K2	CO1
	ii) Outline the following signals: (a) $u(n+2)-u(-n+3)$ (b) $r(-0.5t+2)$	7	K2	CO1
8.	i) Find the fundamental period of the signal $e^{j(\frac{2\pi}{3})n}+e^{j(\frac{3\pi}{4})n}$.	4	K1	CO1
	ii) Show the signal is an energy or power signal (a) $x(t)=(2+e^{-2t})u(t)$ (b) $(\frac{1}{2})^n u(n)$.	6	K1	CO1
	iii) Find the even and odd components of the signal $x(t)=\cos t+\sin t+\cos t\sin t$.	4	K1	CO1

UNIT-II ANALYSIS OF CONTINUOUS TIME SIGNALS

Part-A

S.No	Questions	Marks	BTL	COs
1.	The Fourier series representation is defined for ———————— signals. a) periodic b) aperiodic c) both periodic and aperiodic d) neither periodic nor aperiodic	1	K1	CO2
2.	The existence of Fourier transform can be found by a) The Dirac Delta function b) Dirichlet conditions c) Frequency time uncertainty condition d) Nyquist theorem	1	K1	CO2
3.	What is the fundamental period of the Fourier series of a function f(t)? a) 2π b) 2L c) T d) π	1	K1	CO2
4.	The Fourier transform of a rectangular pulse is _____ a) gaussian b) sinc function c) exponential d) step function	1	K1	CO2
5.	If the function f(x) is even, then which of the following is zero? a) a_n b) b_n c) a_0 d) nothing is	1	K1	CO2

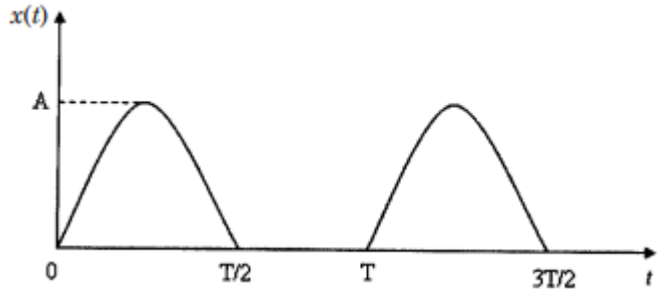
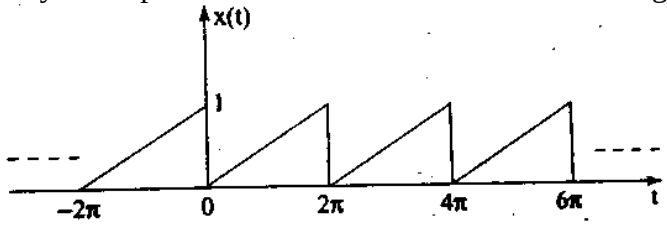
	zero			
6.	What is the Fourier transform of $\cos(\omega_0 t)$ is _____? a) $\frac{\pi}{2j}\delta(\omega-\omega_0)-\delta(\omega+\omega_0)$ b) $\frac{\pi}{j}\delta(\omega-\omega_0)-\delta(\omega+\omega_0)$ c) $\pi\delta(\omega+\omega_0)+\delta(\omega-\omega_0)$ d) $\pi\delta(\omega-\omega_0)+\delta(\omega+\omega_0)$	1	K1	CO2
7.	The Laplace transform of $\sin(\omega_0 t)u(t)$ is a) $\frac{s}{s^2+\omega_0^2}$ b) $\frac{s+\omega_0}{s^2+\omega_0^2}$ c) $\frac{\omega_0}{s^2+\omega_0^2}$ d) $\frac{\omega_0^2}{s^2+\omega_0^2}$	1	K1	CO2
8.	The unit step function in the time domain can be written as _____in frequency domain. a) $\frac{1}{j\omega}+\pi\delta(\omega)$ b) $2\pi\delta(\omega-\omega_0)$ c) $2\pi\delta(\omega+\omega_0)$ d) $2\pi\delta(\omega)$	1	K1	CO2
9.	If a function is odd, its Fourier series contains: a) Only sine terms b) Only cosine terms c) Both sine and cosine terms d) Neither sine nor cosine terms	1	K1	CO2
10.	The existence of Fourier transform can be found by a)The Dirac Delta function b) Dirichlet conditions c) frequency time uncertainty condition d) Nyquist theorem	1	K1	CO2
11.	What is the inverse Laplace transform of $\frac{1}{s^2+4}$? a)sin(2t) b) cos(2t) c) 1/2sin(2t) d) cosh(2t)	1	K1	CO2
12.	What is the region of convergence (ROC) for the Laplace transform of $f(t)=e^{at}$? a) s>a b) s<a c) s>-a d) s<-a	1	K1	CO2
13.	Which of the following statements about the Laplace transform is correct? a) It is only applicable for functions that are periodic. b) It is defined for functions that grow exponentially. c) It converts a time-domain function to a frequency-domain function. d) It only applies to real functions.	1	K1	CO2
14.	Which of the following is a property of the Fourier Transform? a) Linearity b) Time Shifting c) Frequency Shifting d) All of the above	1	K1	CO2
15.	Which of the following properties of the Fourier Transform is associated with a multiplication in the time domain and convolution in the frequency domain? a) Linearity b)Parseval's Theorem	1	K1	CO2

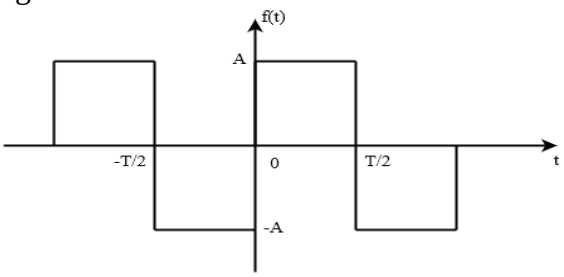
	c) Convolution Theorem d)Scaling Property			

Part-B

S.No	Questions	Marks	BTL	COs
1.	Define the Dirichlet's conditions for the existence of Fourier series.	2	K1	CO2
2.	Show the trigonometric form of Fourier series representation of a periodic signal.	2	K1	CO2
3.	Find the Laplace transform of $x(t) = e^{-4t}u(t)$.	2	K2	CO2
4.	Compare Fourier series and Fourier transform.	2	K1	CO2
5.	Define Fourier transform pair for continuous time signal.	2	K1	CO2
6.	Find the Laplace transform of the signal $\delta(t-5)$ and $u(t-5)$.	2	K1	CO2
7.	State and prove the time shifting property of continuous time Fourier transform.	2	K2	CO2
8.	What is the relationship between Fourier transform and Laplace transform?	2	K1	CO2
9.	Find the Fourier transform of unit step signal.	2	K1	CO2
10.	Define initial value theorem and final value theorem for Laplace transform.	2	K2	CO2
11.	Find the inverse Fourier transform of $X(\omega) = 2\pi\delta(\omega)$.	2	K1	CO2
12.	Show the exponential form of Fourier series representation of a periodic signal.	2	K1	CO2
13.	Classify bilateral and unilateral Laplace transform.	2	K2	CO2
14.	Define the region of convergence of Laplace transform.	2	K1	CO2
15.	Find the Laplace transform of unit ramp function.	2	K1	CO2

Part-B

S.No	Questions	Marks	BTL	COs
1.	Construct the Trigonometric Fourier series for the half wave rectified sine wave given below. 	14	K3	CO2
2.	Identify the exponential Fourier series for the following signal 	14	K3	CO2

3.	i) Find the inverse Laplace Transform of $X(S)=\frac{2(s+2)}{S^2+7s+12}$ for Re(s) > -3.	7	K2	CO2
	ii) Show the inverse Laplace Transform of $X(S)=\frac{(s+2)}{S^3+7s^2+15s+9}$.	7	K2	CO2
4.	Identify the Trigonometric Fourier series for the following signal. 	14	K3	CO2
5.	i) Find the Fourier transform and outline the magnitude and phase spectrum for the signal $x(t)=e^{-0.5t}u(t)$.	7	K2	CO2
	ii) Summarize the properties of Fourier transform.	7	K2	CO2
6.	Solve the Fourier series expansion for a periodic ramp signal with unit amplitude and a period T.	14	K3	CO2
7.	i) Show the Laplace transform for the following signal $x(t)=t^2e^{-t}u(t)$.	7	K2	CO2
	ii) Find the Fourier transform of the given signal. Obtain the magnitude and phase spectra of the given signal $x(t)=te^{-at}u(t)$, a > 0.	7	K2	CO2
8.	Show the inverse Laplace transform of i) $X(s)=\frac{8s+10}{(s+1)(s+2)^3}$ ii) $X(s)=\frac{1-2s^2-14s}{s(s+3)(s+4)}$.	14	K2	CO2

UNIT-III LINEAR TIME INVARIANT (LTI) - CONTINUOUS TIME SYSTEMS

Part-A

S.No	Questions	Marks	BTL	COs
1.	If a system is characterized by the differential equation $\frac{d^2y(t)}{dt^2}+2\frac{dy(t)}{dt}+y(t)=x(t)$, its transfer function is a) $\frac{1}{s^2+2s+1}$ b) $\frac{s^2+2s+1}{1}$ c) $\frac{s^2+2s+1}{s^2}$ d) $\frac{s^2+2s+1}{s}$	1	K1	CO3
2.	An LTI system is memoryless only if _____ a) It does not store the previous value of the input b) It does not depend on any previous value of the input c) It does not depend on stored values of the system d) It does not depend on the present value of the input	1	K1	CO3

3.	When are LTI systems stable? a) Only when bounded input produces a bounded output b) Only when bounded input produces a unbounded output c) Only when unbounded input produces a bounded output d) Only when unbounded input produces an unbounded output	1	K1	CO3
4.	In the Laplace domain, the transfer function H(s) of a system is: a) The Fourier transform of the impulse response b) The ratio of the output to the input in the Laplace domain c) The inverse Laplace transform of the system's impulse response d) The Fourier transform of the system's input	1	K1	CO3
5.	What does the associative property apply? a) Parallel connection of two systems is equivalent to a single system only in case of a continuous system b) Series and parallel interconnection of two systems is equivalent to a single system only in case of discrete system c) Series interconnection of two systems is equivalent to a single system in case of both continuous and discrete system d) Series interconnection of two systems is equivalent to a single system only in case of discrete	1	K1	CO3
6.	If the impulse response of a system is $H(s) = e^{-2t}u(t)$, the transfer function H(s) of the system is _____ a) $\frac{1}{s+2}$ b) $\frac{1}{s-2}$ c) $\frac{s}{s+2}$ d) $\frac{1}{s^2+2}$	1	K1	CO3
7.	If a system is described by the transfer function, $H(s) = \frac{5}{s+1}$, the system has a) One pole at s=−1 b) One zero at s=−5 c) A frequency response of $\frac{5}{j\omega+1}$ d) A system response of a delta function	1	K1	CO3
8.	What is the rule h*(x+y) = (y+x)*h called? a) Commutativity rule b) Associativity rule c) Distributive rule d) Transitive rule	1	K1	CO3
9.	The convolution integral for a continuous-time system is given by a) $y(t) = x(t) * h(t) = \int_{-\infty}^{\infty} x(\tau)h(t-\tau)d\tau$ b) $y(t) = \int_{-\infty}^{\infty} x(t-\tau)h(\tau)d\tau$ c) $y(t) = \int_{0}^{\infty} x(\tau)h(t-\tau)d\tau$	1	K1	CO3

	d) $y(t) = \int_0^t x(\tau)h(t-\tau)d\tau$			
10.	In a continuous-time system, what is the impulse response of the system if its transfer function is $H(s) = \frac{1}{(s+2)}$ a) e^{-2t} b) e^{2t} c) $1-e^{-2t}$ d) $1+e^{2t}$	1	K1	CO3
11.	What is the main difference between the Fourier transform and the Laplace transform? a) The Fourier transform is used for non-periodic signals, while the Laplace transform is for periodic signals. b) The Laplace transform includes a real part for exponential decay, while the Fourier transform does not. c) The Fourier transform is only used in the time domain, while the Laplace transform is only used in the frequency domain. d) There is no significant difference between the two transforms.	1	K1	CO3
12.	In a continuous-time system, if the transfer function has a pole at s=−2, the system will: a) Be stable b) Be unstable c) Be marginally stable d) Exhibit an oscillatory behavior	1	K1	CO3
13.	Which of the following is true for a system with a stable transfer function in the Laplace domain? a) All the poles of the transfer function lie on the left half of the s-plane b) The impulse response is unbounded c) The system is non-causal d) The Fourier transform does not exist	1	K1	CO3
14.	The region of convergence (ROC) for the Laplace transform is determined by: a)The range of values of t where the function is defined b)The location of poles and zeros in the s-plane c)The maximum value of the system's gain d)The boundary of the time domain	1	K1	CO3
15.	The frequency response of a system can be found by evaluating the transfer function at a) $s = j\omega$ b) $s = 0$ c) $s = -j\omega$ d) $s = \infty$	1	K1	CO3

Part-B

S.No	Questions	Marks	BTL	COs
1.	Define ROC.	2	K1	CO3
2.	Compare natural response and forced response.	2	K2	CO3
3.	Find the final value $x(\infty)$, given that $X(s) = \frac{s+5}{s+3}$.	2	K1	CO3
4.	Define convolution integral.	2	K1	CO3

5.	Find the differential equation representation of the system $H(s)=\frac{s}{s^2+2s+1}$.	2	K1	CO3
6.	When the linear time invariant continuous time system is said to be stable?	2	K1	CO3
7.	Given the differential equation representation of a continuous time system $2\frac{d^2y(t)}{dt^2}-3\frac{dy(t)}{dt}+y(t)=3x(t)$. Find the frequency response $H(j\omega)$.	2	K2	CO3
8.	List the properties of convolution integral.	2	K1	CO3
9.	Outline the block diagram of the LTI system described by $\frac{dy}{dt}+y(t)=0.1x(t)$.	2	K2	CO3
10.	What is $u(t-2)*f(t-1)$?	2	K1	CO3
11.	Find the step response of a LTI system with impulse response $h(t)=\delta(t)-\delta(t-1)$.	2	K2	CO3
12.	What is meant by region of convergence?	2	K1	CO3
13.	Perform convolution of the causal signal $x_1(t)=2u(t), x_2(t)=u(t)$ using Laplace transform.	2	K2	CO3
14.	What is the advantage of direct form II realization structure?	2	K1	CO3
15.	A causal LTI system satisfies the linear differential equation $5\frac{dy(t)}{dt}+6y(t)=2x(t)$. Find the frequency response $H(j\omega)$ of the system.	2	K2	CO3

Part-B

S.No	Questions	Marks	BTL	COs
1.	Using Laplace transform solve the response of the system described by the equation $\frac{d^2y(t)}{dt^2}+5\frac{dy(t)}{dt}+4y(t)=\frac{dx(t)}{dt}$ with initial conditions $y(0)=0;\left.\frac{dy(t)}{dt}\right\|_{t=0}=1$ for the input $x(t)=e^{-2t}u(t)$.	14	K3	CO3
2.	Construct direct form I, II, cascade and parallel form realization structure for the given LTI system $H(s)=\frac{4s+28}{s^2+6s+5}$.	14	K3	CO3
3.	Consider the system characterized by the differential equation $x(t)=\frac{d^3y(t)}{dt^3}+6\frac{d^2y(t)}{dt^2}+11\frac{dy(t)}{dt}+6y(t)$. (i) Find the zero-state response of the system for the input $x(t)=e^{-4t}u(t)$. (ii) Find the zero input response of the system given that y(0)=1.	14	K2	CO3
4.	i) Show the impulse response of the continuous time system described by the differential	7	K2	CO3

	equation $\frac{d^2y(t)}{dt^2}+4\frac{dy(t)}{dt}+3y(t)=\frac{dx(t)}{dt}+2x(t)$.			
	ii) Find the impulse response of causal system described by $H(s)=\frac{(s+3)}{s^2+4s+3}$.	7	K2	CO3
5.	i)The differential equation of the system is given as, $\frac{d^2y(t)}{dt^2}+5\frac{dy(t)}{dt}++6y(t)=-\frac{dx(t)}{dt}$. Using Fourier transform determine the impulse response of the system.	7	K2	CO3
6.	ii)Given the transfer function of a continuous time system $H(s)=\frac{2}{s^2+3s+2}$. Find the differential equation relating input and output, impulse response h(t) and determine whether the system is stable.	7	K2	CO3
7.	i) Construct direct form I and II for the given LTI system $\frac{d^2y(t)}{dt^2}+5\frac{dy(t)}{dt}+4y(t)=\frac{dx(t)}{dt}$.	7	K3	CO3
	ii) Construct cascade and parallel form of $H(s)=\frac{1}{(s+1)(s+2)}$.	7	K3	CO3
8.	Apply convolution integral for the following signals i) $x_1(t)=e^{-2t}u(t)$; $x_2(t)=e^{-4t}u(t)$ ii) $x_1(t)=\cos tu(t)$; $x_2(t)=u(t)$	14	K3	CO3

UNIT-IV ANALYSIS OF DISCRETE TIME SIGNALS

Part-A

S.No	Questions	Marks	BTL	COs
1.	Find the Nyquist rate and Nyquist interval of sin(2πt). a) 2 Hz, 12 sec b) 12 Hz, 12 sec c) 12 Hz, 2 sec d) 2 Hz, 2 sec	1	K1	CO4
2.	How can aliasing be prevented when sampling a continuous-time signal? a) By reducing the sampling frequency b) By applying an ideal low-pass filter before sampling c) By sampling at a rate equal to the Nyquist rate d) By increasing the bandwidth of the signal	1	K1	CO4
3.	The sampling frequency of a signal is F_s = 2000 samples per second. Find its Nyquist interval. a) 0.5 sec b) 5 msec c) 5 sec d) 0.5 msec	1	K1	CO4
4.	The inverse Z-transform of $z/(z+1)^2$ is _____ a) $(-1)^{n+1}$ b) $(-1)^{n-1}$ n c) $(-1)^{n-1}$ d) $(-1)^{n+1}$ n	1	K1	CO4
5.	Which property of the Z-transform is related to the shifting of a signal in time? a) Time reversal b) Time scaling c) Time shifting	1	K1	CO4

	d) Frequency shifting			
6.	The Z-transform of a signal x(n) is X(z). What is the Z-transform of x(n-2)? a)$z^2X(z)$ b) $X(z^2)$ c) $z^{-2}X(z)$ d) $X(z^{-2})$	1	K1	CO4
7.	Find the Z-transform of δ(n+3). a) z b) z^2 c) 1 d) z^3	1	K1	CO4
8.	What is the primary purpose of the Discrete-Time Fourier Transform (DTFT)? a) To convert a continuous-time signal to a discrete-time signal. b) To analyze the frequency components of a discrete-time signal. c) To convert a discrete-time signal into a continuous-time signal. d) To filter out high-frequency components from a signal.	1	K1	CO4
9.	Which of the following is true about the Nyquist rate? a) The Nyquist rate is always twice the highest frequency component of the signal b) The Nyquist rate is always the same as the highest frequency component c) The Nyquist rate is independent of the signal's frequency d) The Nyquist rate can be below the highest frequency component for accurate reconstruction	1	K1	CO4
10.	What is the result of the DTFT of a unit impulse sequence δ[n]? a) X(f)=0 b) X(f)=1 c) X(f)=δ(f) d) X(f)=∞	1	K1	CO4
11.	Find the Z-transform of u(-n). a) 1/1−z b) 1/1+z c) z/1−z d) z/1+z	1	K1	CO4
12.	What is the DTFT of the sequence given $x(n) = \alpha^n u(n), \alpha < 1$? a) $\frac{1}{1-\alpha e^{-j\omega}}$ b) $\frac{1}{1-\alpha e^{j\omega}}$ c) $\frac{\alpha}{1-\alpha e^{-j\omega}}$ d) $\frac{\alpha}{1+\alpha e^{j\omega}}$	1	K1	CO4
13.	What is the main advantage of using the Z-transform over the Fourier Transform? a) The Z-transform handles both stability and causality of systems b) The Fourier Transform provides better accuracy c) The Z-transform cannot handle complex signals d) The Z-transform is limited to only periodic signals	1	K1	CO4
14.	The DTFT of a discrete-time signal is given by $X(f) = \sum_{n=-\infty}^{\infty} x(n)e^{-j2\pi fn}$ What would be the DTFT of a time-shifted signal x[n−m]? a) $X(f)e^{j2\pi fm}$ b) $X(f)e^{-j2\pi fm}$ c) $X(f)$ d) $X(f)e^{j2\pi m}$	1	K1	CO4
15.	Determine the Nyquist rate of the signal x(t) = 1 + cos2000πt + sin4000πt. a) 2000 Hz b) 4000 Hz c) 1 Hz d) 6000 Hz	1	K1	CO4

Part-B

S.No	Questions	Marks	BTL	COs
1.	Define sampling theorem.	2	K1	CO4
2.	Find the Nyquist rate of the signal $x(t) = \sin 200\pi t - \cos 100\pi t$	2	K2	CO4
3.	What is the need for sampling a continuous time signal?	2	K1	CO4
4.	What is aliasing and how it is overcome?	2	K1	CO4
5.	Compare one sided Z-transform and Two-sided Z-transform.	2	K2	CO4
6.	List any two properties of DTFT.	2	K1	CO4
7.	Define Nyquist rate.	2	K1	CO4
8.	List any two properties of the region of convergence of the Z transform.	2	K1	CO4
9.	Given $x(n) = \{1, \underset{\uparrow}{2}, -3, 4, 5\}$ find Z transform and its ROC.	2	K1	CO4
10.	What is meant by ROC of Z transform?	2	K1	CO4
11.	Find the Nyquist rate for the signal $x(t) = 1 + \cos 200\pi t + \sin 500\pi t$.	2	K2	CO4
12.	What is the z transform of $\delta(n+k)$?	2	K1	CO4
13.	Find the Z-transform of unit impulse signal δ[n] and sketch its ROC.	2	K2	CO4
14.	Compare 'S' plane and 'Z' Plane.	2	K2	CO4
15.		2	K2	CO4

Part-C

S.No	Questions	Marks	BTL	COs
1.	Explain in detail about sampling theorem and how it is reconstructed for a band limited signal.	14	K2	CO4
2.	Show the inverse Z transform of $X(z) = \dfrac{z^{-1}}{1 - 0.25z^{-1} - 0.375z^{-2}}$. For (i) ROC $\lvert z \rvert > 0.75$ (ii) ROC $\lvert z \rvert > 0.5$	14	K2	CO4
3.	Find the Z transform of $x(n) = n^2 u(n)$.	7	K2	CO4
4.	Show the inverse Z transform of the system function $H(Z) = \dfrac{z^2 - 3z + 8}{(z-2)(z+2)(z+3)}$.	7	K2	CO4
5.	Summarize the properties of Z Transform.	14	K2	CO4
6.	Show the discrete time Fourier transform of $x(n) = \left(\dfrac{1}{2}\right)^{n-1} u(n-1)$.	7	K2	CO4
7.	Find the inverse Z transform of $X(Z) = \dfrac{1}{1 - 1.5z^{-1} + 0.5z^{-2}}$ for ROC $\lvert Z \rvert$>1.	7	K2	CO4
8.	A LTI system is characterized by $X(Z) = \dfrac{z+2}{2z^2 - 7z + 3}$ find the ROCs for $\lvert Z \rvert > 3, \lvert Z \rvert > \dfrac{1}{2}, \dfrac{1}{2} < \lvert Z \rvert < 3$.	14	K2	CO4

UNIT-V LINEAR TIME INVARIANT (LTI) - DISCRETE TIME SYSTEMS

Part-A

S.No	Questions	Marks	BTL	COs
1.	Which of the following is a first-order difference equation? a) y(n)−3y(n−1)+2y(n−2)=0 b) y(n)+5y(n−1)=10 c) y(n)−4y(n−2)+y(n−3)= 7 d) y(n+1)−2y(n)+y(n−1)= 0	1	K1	CO5
2.	The Discrete Fourier Transform (DFT) of a sequence is defined as: a) $X(k) = \sum_{n=0}^{N-1} x(n) e^{-j2\pi kn/N}$ b) $X(k) = \sum_{n=0}^{N-1} x(n) e^{j2\pi kn/N}$ c) $X(k) = \sum_{\infty}^{-\infty} x(n) e^{-j2\pi kn/N}$ d) $X(k) = x(n)$	1	K1	CO6
3.	Which of the following statements is true for Radix-2 DIT-FFT? a) The input sequence is in bit-reversed order b) The output sequence is in bit-reversed order c) The input sequence is in natural order d) The computation is done in the frequency domain	1	K1	CO6
4.	In FFT, the twiddle factor is represented as: a) $e^{-j2\pi k/N}$ b) $e^{j2\pi k/N}$ c) $e^{-j2\pi n/N}$ d) $e^{-j\pi n/N}$	1	K1	CO6
5.	The periodicity property of DFT states that: a) X(k)=X(k+N) b) X(k)=−X(N−k) c) X(k)=X(N−k) d) X(k)=X(k−1)	1	K1	CO6
6.	In a block diagram representation of a system, what does a summing junction do? a) Multiplies input signals b) Adds or subtracts input signals c) Stores past values of signals d) Converts signals from analog to digital	1	K1	CO5
7.	The convolution sum for a discrete-time system is given by: a) y(n)=x(n)+h(n) b) y(n)=x(n)·h(n) c) y(n)= $\sum_{k=-\infty}^{\infty} x(k)h(n-k)$ d) y(n)=∫x(t)h(n−t)dt	1	K1	CO5
8.	In linear convolution, if the lengths of two signals are N and M, what is the length of the output? a) N+M−1 b) N c) M d) N×M	1	K1	CO5
9.	The number of complex additions required in an N-point FFT is: a) N^2 b) N / 2 c) $N \log_2 N$ d) N^3	1	K1	CO6
10.	What is the main advantage of the Fast Fourier Transform (FFT) over the DFT? a) Less memory usage b) Higher accuracy c) Reduced computational complexity d) Works only for even-length sequences	1	K1	CO6

11.	How many complex multiplications are required in an N-point DFT using the direct method? a) N $\log_2 N$ b) N^2 c) N / 2 d) $\log_2 N$	1	K1	CO6
12.	Which of the following statements is true regarding linear and circular convolution? a) Linear convolution is always periodic, whereas circular convolution is not. b) Circular convolution is equivalent to linear convolution when zero-padding is applied. c) Linear convolution can only be used for finite-length sequences. d) Circular convolution is used only in time-domain analysis.	1	K1	CO5
13.	What is the number of stages in an N-point Radix-2 FFT? a) N/2 b) $\log_2 N$ c) N^2 √N	1	K1	CO6
14.	What is the result of circular convolution of two signals of length N and M? a) The output length is 2N−1 b) The output length is N. c) The output length is N+M−1 d) The output length is infinity	1	K1	CO5
15.	How many complex multiplications are required for an 8-point FFT using the Radix-2 algorithm? a) 16 b) 12 c) 24 d) 32	1	K1	CO6

Part-B

S.No	Questions	Marks	BTL	COs
1.	Compare direct form I and direct form II realization.	2	K2	CO5
2.	Find the z transform of $x(n) = u(n-2) * \left(\frac{2}{3}\right)^n u(n)$.	2	K2	CO5
3.	Compare DFT and FFT.	2	K2	CO6
4.	Outline the basic butterfly diagram for the computation in the radix-2 DIF FFT algorithm.	2	K2	CO6
5.	List the methods for finding the inverse Z transform.	2	K2	CO5
6.	Find the convolution of two sequences x(n) = {1,2,-1,3) and h(n)= {1,2,2}.	2	K2	CO5
7.	Find Z transform of x(n)={1,2,3,4}.	2	K2	CO5
8.	Define convolution sum.	2	K1	CO5
9.	Find the z-transform and its associated ROC for $x(n) = \{1, -1, 2, \underset{\uparrow}{3}, 4\}$.	2	K2	CO5
10.	List the applications of FFT.	2	K2	CO6
11.	Classify recursive and non-recursive systems.	2	K2	CO5
12.	Compare DIT and DIF FFT.	2	K2	CO6
13.	How many multiplications and addition required to compute FFT for a sequence size N=64?	2	K1	CO6
14.	Show the convolution of the signals x[n] = {2, –1, 3, 2} and h[n] = {1, –1,1,1}.	2	K2	CO5

15.	Given the system function $H(z) = 2 + 3z^{-1} + 4z^{-3} - 5z^{-4}$. Find the impulse response h(n).	2	K2	CO5

Part-C

S.No	Questions	Marks	BTL	COs
1.	i) Apply convolution sum of the signal $x(n) = \cos \pi n u(n)$ and $h(n) = (1/2)^n u(n)$.	7	K3	CO5
	ii) Solve the impulse response of the system given by the difference equation $y(n) - \frac{5}{6} y(n-1) + \frac{1}{6} y(n-2) = x(n)$.	7	K3	CO5
2.	i) Solve impulse response and step response of $y(n) + y(n-1) - 2y(n-2) = x(n-1) + 2x(n-2)$	7	K3	CO5
	ii) Develop cascade and parallel form of block diagram realization structure for the following system function, $H(z) = \frac{1}{(1+\frac{1}{2}z^{-1})(1-\frac{1}{4}z^{-1})}$.	7	K3	CO5
3.	Construct cascade and parallel form realization for the following system. $y(n) = -0.1y(n-1) + 0.2y(n-2) + 3x(n) + 3.6x(n-1) + 0.6x(n-2)$.	14	K3	CO5
4.	i) Find the linear convolution of the sequences x (n) = {1, 1, 1, 1} and h (n) = {2, -1, -2, -1}.	7	K2	CO5
	ii) Perform convolution to find the response of the system $h(n) = \{1, -2, 3, -1\}$ for the input sequence $x(n) = \{1, -1, 2, 3\}$.	7	K2	CO5
5.	Find the DFT of the sequence x(n)={1,1,2,2 }	7	K2	CO6
	Find the 8-point DFT of the sequence $x(n) = \{2, 2^2, 2^3, 2^4\}$.	7	K2	CO6
6.	Find the IDFT of the sequence $X(K) = \{4, 1 - j2.414, 0, 1 - j0.414, 0, 1 + j0.414, 0, 1 + j2.414\}$.	14	K2	CO6
7.	Solve the 8-point DFT of the sequence $x(n) = \begin{Bmatrix} 1 \; for \; 0 \le n \le 7 \\ 0 \; for \; otherwise \end{Bmatrix}$ using DIT algorithm.	14	K3	CO6
8.	Develop the FFT of the following sequence using DIT and DIF Radix-2 algorithm. {1,-1, 1,-1, 1,-1, 1,-1}.	14	K3	CO6

Course Tutor **HOD/ECE**