GURU NANAK INSTITUTE OF TECHNOLOGY
An Autonomous Institute under MAKAUT
2022
SIGNALS AND SYSTEMS
EC304

TIME ALLOTTED: 3Hours **FULL MARKS:70**

The figures in the margin indicate full marks.
Candidates are required to give their answers in their own words as far as practicable

GROUP – A
(Multiple Choice Type Questions)

Answer any ***ten*** from the following, choosing the correct alternative of each question: 10×1=10

			Marks	CO No
1.	i)	Determine the Z transform of the function x(n)= n25nu(n) a. X(z)=5z(z+5)/(z-5)3 b. X(z)=3z(z+5)/(z-5)3 c. X(z)=2z(z+3)/(z-5)2 d. X(z)=5z(z+5)/(z-5)2	1	CO3
	ii)	A time invariant system is a system whose output a. increases with a delay in input b. decreases with a delay in input c. remains same with a delay in input d. vanishes with a delay in input	1	CO1
	iii)	Which of the following is not Dirichlet's condition for the Fourier series expansion? a. f(x) is periodic, single valued, finite b. f(x) has finite number of discontinuities in only one period c. f(x) has finite number of maxima and minima d. f(x) is a periodic, single valued, finite	1	CO3
	iv)	For a system function H(s) to be stable a. The zeros lie in left half of the s plane b. The zeros lie in right half of the s plane c. The poles lie in left half of the s plane d. The poles lie in right half of the s plane	1	CO1
	v)	If a signal f(t) has energy E, the energy of the signal f(100t) is equal to _____ a. E b. 100E c. E/100 d. 400E	1	CO2
	vi)	One of the types of signal is an Impulse train. The type of discontinuity in an impulse train is _____ a. Infinite b. Zero c. One d. Finite	1	CO2

vii) A periodic signal $x(t)$ of period T_0 is given by — 1 — CO2

$$x(t) = 1 \quad |t| < T_1$$

$$= 0 \quad T_1 < |t| < \frac{T_0}{2}$$

The dc component of $x(t)$ is

a. $\frac{T_1}{T_0}$
b. $\frac{T_1}{2T_0}$
c. $\frac{2T_1}{T_0}$
d. $\frac{T_0}{T_1}$

viii) The ROC of a system is the — 1 — CO3

a. range of z for which the z transform converges
b. range of frequency for which the z transform exists
c. range of frequency for which the signal gets transmitted
d. range in which the signal is free of noise

ix) The region of convergence of the z-transform of a unit step function is — 1 — CO4

a. $|z| > 1$
b. $|z| < 1$
c. (Real part of z) > 0
d. (Real part of z) < 0

x) The z-transform of the following real exponential sequence — 1 — CO4

$$x(n) = a^n n \geq 0$$

$= 0$ for $n < 0$ is given by

a. $1 - az^{-1};\ |z| > a$
b. $\frac{1}{1-az^{-1}};\ |z| > a$
c. $-\frac{1}{1-az};\ |z| > a$
d. $1 + az^{-1};\ |z| < a$

xi) The discrete time system y(n)=x(n-3)-4x(n-10) is a — 1 — CO1

a. Time varying system
b. Dynamic system
c. Memoryless system
d. None of these

xii) Determine the Time period of: x(t)=3 cos(20t+5)+sin(8t-3). — 1 — CO1

a. 1/10 sec
b. 1/20 sec
c. 2/5 sec
d. 2/4 sec

GROUP – B
(Short Answer Type Questions)

Answer any ***three*** from the following: **3×5=15**

		Marks	CO No
2.	Determine whether the system y (n) = $(1/2)^n$ u(n) stable orunstable?	5	CO4
3.	What is time reversal operation on a signal and draw the following signal: $u(n+2) - u(n-3)$	5	CO2

4.	(a)	What is probability density function (PDF)?	2	CO5
	(b)	Find the cross correlation of two finite length sequences x(n)={1,2,1,1} and y(n)={1,2,1,1}	3	CO3
5.		Explain the properties of Region Of Convergence (ROC)of$X(z)$.	5	CO4
6.		Determine the Fourier transform of the followings $x(t) = e^{-at}u(t)$	5	CO3

GROUP – C
(Long Answer Type Questions)

Answer any ***three*** from the following: **3×15=45**

			Marks	CO No
7.	(a)	Find the Nyquist rate of 9cos(80*pi*t) - 5cos(60*pi*t)-10sin(480*pi*t)	5	CO1
	(b)	Explain with example the time invariant and time invariant system.	5	CO1
	(c)	Check whether the following systems are static or dynamic i) y(n)=x(n)x(n-1) ii) y(n)=x2(n)+x(n)	5	CO2
8.	(a)	Explain if the system described is causal or non-causal $y(n) = x(n) + \frac{1}{x(n-1)}$	5	CO2
	(b)	Determine the convolution sum of two sequences: $x(n) = \{1, 2, 0, 1\} : \underset{\uparrow}{} (n) = \{1, 1, 2, 0\}$	5	CO2
	(c)	Find the discrete-time Fourier Transform of $x(n) = [3, -4, 5, 6]$	5	CO3
9.	(a)	State and proof the sampling theorem with example	4	CO2
	(b)	Find the Fourier series coefficients for the continuous time periodic signal. $x(t) = 1.5 \quad for\ 0 \le t \le 1$ $= -1.5 \quad for\ 1 \le t \le 2$ with fundamental frequency $\Omega_0 = \pi$	6	CO2
	(c)	Determine the inverse z-transform of $X(z) = \frac{1 + 2z^{-1}}{1 - 2z^{-1} + z^{-2}}$	5	CO3
10.	(a)	State and prove initial and final value theorem of z-transform.	5	CO4
	(b)	Determine the Z transform and ROC of the signal X(n)=anu(n)+bnu(-n-1)	7	CO4
	(c)	What do you mean by Exponential Fourier Series?	3	CO4
11.		Write short notes on any ***three*** of the following:	3x5=15	
	(a)	Even and Odd signals	5	CO1
	(b)	Initial value theorem	5	CO2
	(c)	Gibb's phenomenon	5	CO3
	(d)	Properties of continuous time Fourier transform	5	CO5
	(e)	Periodic and aperiodic signal.	5	CO4