GURU NANAK INSTITUTE OF TECHNOLOGY
An Autonomous Institute under MAKAUT
2021
SIGNALS AND SYSTEMS (Backlog)
EC401

TIME ALLOTTED: 3 HOURS **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)	The signal $x(n)=(1/2)^n u(n)$ is a) Power signal b) Energy Signal c) Both Energy and Power signal d) None of these	1	CO2
	(ii)	The system y[n] = sin(x[n]) is a) Periodic b) Aperiodic c) Causal d) Noncausal	1	CO2
	(iii)	The Fourier coefficient a_n can be evaluated as a) $\frac{2}{T}\int_0^T x(t)cosnwtdt$ b) $\frac{2}{T}\int_{-\alpha}^{\alpha} x(t)cosnwtdt$ c) $\frac{2}{T}\int_{-T/2}^{T/2} x(t)cosnwtdt$ d) $\frac{2}{T}\int_0^{\alpha} x(t)cosnwtdt$	1	CO2
	(iv)	Check the system y[n] = x[n] – x[n-2] is a) With memory b) Without memory c) With small memory d) None	1	CO2
	(v)	If x(t) is odd, then its Fourier series coefficients must be a) Real and odd b) imaginary and odd c) real and even d) imaginary and even	1	CO2
	(vi)	A linear discrete-time system has the characteristic equation z^3 - 0.81z=0. The system a) is stable b) is marginally stable c) is unstable d) limitedly stable	01	CO4

(vii)	The type of systems which are characterized by input and the output quantized at certain levels are called as a) analog b) discrete c) continuous d) digital		1	CO5
(viii)	The Fourier transform of a rectangular pulse is a) Impulse b) Triangular pulse c) Sine function d) Sinc function		1	CO3
(ix)	The Z-Transform X(z) of a discrete time signal x(n) is defined as: a) $\sum_{n=-\infty}^{\infty} x(n)z^{n}$ b) $\sum_{n=-\infty}^{\infty} x(n)z^{-n}$ c) $\sum_{n=0}^{\infty} x(n)z^{n}$ d) None of the mentioned		1	CO4
(x)	What is the ROC of the signal x(n)=δ(n-k),k>0? a) z=0 b) z=∞ c) Entire z-plane, except at z=0 d) Entire z-plane, except at z=∞		1	CO3
(xi)	The similarity between the Fourier transform and the z transform is that a) Both convert frequency spectrum domain to discrete time domain b) Both convert discrete time domain to frequency spectrum domain c) Both convert analog signal to digital signal d) Both convert digital signal to analog signal		1	CO4
(xii)	A variable that can assume any value between two given points is called a) Continuous random variable b) Discrete random variable c) Irregular random variable d) Uncertain random variable		1	

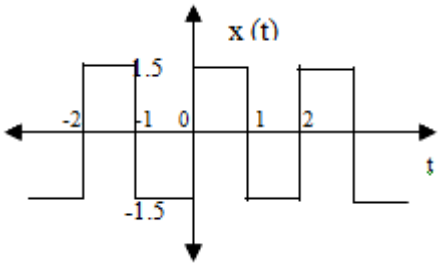
GROUP – B
(Short Answer Type Questions)

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

			Marks	CO No
2.	(a)	State the condition for existence of Fourier series.	2	CO2
	(b)	What is aliasing? What is an anti-aliasing filter?	3	CO5
3.	(a)	Find even and odd component of the signal x(n)={-2, 1, 2 ,-1, 3}	3	CO1

	(b)	A continuous time signal is defined as $x(t)= e^{-at}$, a>0 Find the Fourier Transform of x(t).	2	CO3
4.	(a)	If x(n) is causal sequence which is shifted by 'm' amount, prove that $z\{x(n-m)\} = z^{-m}\{X_+(z) + \sum_{K=1}^{m} x(-k)z^k\}$.	5	CO3
5.	(a)	Find the Nyquist rate of i) 7sin 800*pi*t - 5cos 600*pi*t-10sin1800*pi*t ii) -2.5sin (800*pi*t) x cos(600*pi*t)	5	CO1
6.		Sketch the following signal and calculate their energies		
		i. e^{-10t} u(t)	5	CO1
		ii. u(t) –u(t-15)		CO1

GROUP – C
(Long Answer Type Questions)
Answer any ***three*** from the following: **3×15=45**

			Marks	CO No
7.	(a)	Discuss the importance of convolution sum.	3	CO2
	(b)	Prove that if two systems are connected in parallel the overall impulse response is equal to sum of two impulse responses	6	CO2
	(c)	Find the convolution of two sequences x_1 (n)={1,-1,2,3} x_2 (n)={1,-2,3,1} using Matrix method	6	CO2
8.	(a)	State and prove initial and final value theorem of z-transform.	5	CO4
	(b)	Find the z-transform and ROC of the sequence x (n)= $(1/2)^n$ u(-n)	5	CO4
	(c)	Find the inverse Z transform of $X(z)= \frac{z(z-1)}{(z+2)^3(z+1)}$ ROC:|z|>2	5	CO3
9.	(a)	Check the followings for the system y(n)= x(n+1) +1/x(n+1) (i) Static & Dynamic (ii) Linear & Nonlinear (iii) Causal & Non-Causal	6	CO1,CO2
	(b)	Explain the even symmetry and odd symmetry of Fourier series.	4	CO3
	(c)	Find the Fourier series coefficients for the continuous time periodic signal x (t)=1.5 for 0≤t <1 =-1.5 for 1≤t<2 	5	CO3

10.	(a)	Determine the convolution output of the two signals using graphical method. x(n)={3,3,1,1} and h(n)={1,2,1,1}	7	CO3
	(b)	Check whether the signal is causal or noncausal. i) y(t) = x(t)cos(t+1) ii) y(n) = x (n^3)	4	CO3
	(c)	Prove that the z-transform of convolution of x(n) and h(n) is the multiplication of z-transform of individual.	4	CO2
		Write short notes on any three of the following	5x3=15	
11.				
	(a)	Nyquist Sampling Theorem	5	CO1
	(b)	Random variables	5	CO5
	(c)	Difference between FT and DTFT	5	CO3
	(d)	Invertible and Non-invertible System,	5	CO4
	(e)	BIBO Stability	5	CO3