Roll No. | | | | | | | | | | |

ANNA UNIVERSITY (UNIVERSITY DEPARTMENTS)

B.E. /B. Tech / B. Arch (Full Time) - END SEMESTER EXAMINATIONS, APR / MAY 2024

ELECTRONICS AND COMMUNICATION ENGINEERING

III Semester

EC5304 Signals and Systems

(Regulation 2019)

Time:3 hrs Max. Marks: 100

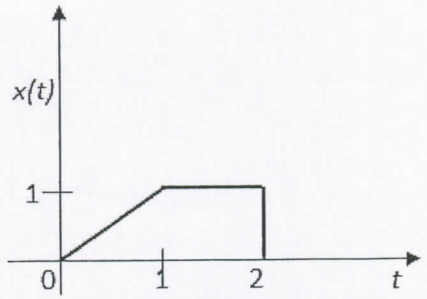
CO1	Ability to clarify signals and systems based on various characteristics and decomposition for easier analysis
CO2	Ability to determine and analyze frequency components of signals and frequency response of the systems
CO3	Ability to determine and analyze the capability and stability LTI systems for their impulse response
CO4	Ability to convert the CT signals into DT signals and analyze, the effect of sampling and frequency content of DT signals
CO5	Ability to analyze LTI systems and realize with various structures

BL – Bloom's Taxonomy Levels

(L1-Remembering, L2-Understanding, L3-Applying, L4-Analysing, L5-Evaluating, L6-Creating)

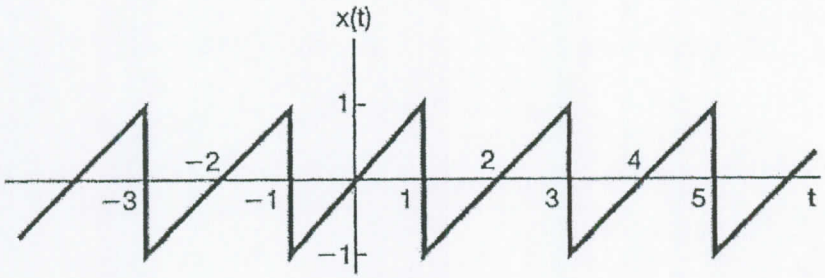
PART- A (10x2=20Marks)

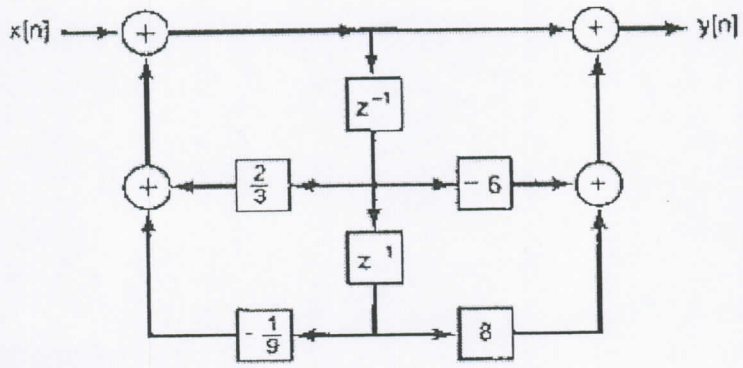
(Answer all Questions)

Q. No.	Questions	Marks	CO	BL
1	Check the periodicity of the given signal, **x(t)= 10 sin25πt + cos 10πt**. If periodic, find the fundamental period.	2	1	3
2	For the given signal x(t) in Fig.1. sketch **x(3/2t+1)**  **Fig.1**	2	1	3
3	State Parseval's relation for continuous time periodic signals.	2	2	1
4	State time shifting and time scaling properties of CT Fourier transform.	2	2	1
5	An LTI system is given by, $y(t) = \frac{d}{dt}x(t)$. Find H(jω).	2	3	3
6	Two LTI systems with impulse responses $h_1(t)=u(t)$ and $h_2(t)=u(t-1)$ respectively are connected in parallel. Determine the overall response	2	3	3
7	An LTI system has an impulse response of $h[n] = \delta[n - n_0]$, find $Y(e^{j\omega})$.	2	4	3
8	State Sampling theorem.	2	4	1
9	If X(z) is the Z transform of x[n] with ROC = R, what is the Z-transform of x[-n] and what is its ROC?	2	5	2
10	Convolve the following signals x[n]={1,2,3} h[n]={1,2} ↑ ↑	2	5	3

PART- B (5x 13=65Marks)

(Restrict to a maximum of 2 subdivisions)

Q. No.	Questions	Marks	CO	BL
11 (a)	Determine which of the following properties hold and which does not hold for the given discrete-time system **y[n] = x[n-2] - 2x[n-8]** i) Memoryless (2) ii) Time Invariant (3) iii) Linear (3) iv) Causal (2) v) Stable (3) Justify your answers.	13	1	3
	OR			
11 (b)	i) Determine the energy and power of the signal **$x(t)= e^{2t} u(-t)$** (6)	13	1	3
	ii) Find the even and odd parts of the signal **$x(t) = 4e^{-0.5t}$** and sketch it. (7)			
12 (a)	i) Determine the Fourier series representation of the following signal shown in Fig.2. (7)  **Fig.2**	13	2	3
	ii) Find the Laplace transform and plot the ROC of the signal **$x(t) = e^{-2t}u(t) + e^{2t}u(-t)$**. (6)			
	OR			
12 (b)	i) Compute the Fourier transform of the signal **$x(t) = e^{at} u(t)$, a>0** and sketch its magnitude and phase spectrum. (7)	13	2	3
	ii) Find the Laplace transform for the signal **$x(t)=e^{-a\|t\|}$** Indicate ROC in the s- plane for a<0 and a>0. (6)			
13 (a)	i) Find the frequency response and impulse response of the LTI system for **$x(t) = e^{-2t} u(t)$** and **$y(t) = e^{-t} u(t)$**. (6)	13	3	4
	ii) The input and impulse response of a CT-LTI system are given as **$x(t) = e^{2t} u(-t)$** and **$h(t)= u(t-3)$**. Find the output y(t) of the system. (7)			
	OR			
13 (b)	i) Given $H(S) = {}^{1}/_{S^2 - S - 6}$, **R{S}>3**, check if the system is causal or non-causal and stable or unstable. (6)	13	3	4
	ii) The input and output of a causal LTI system is described by the following differential equation, $${}^{d^2y(t)}/_{dt^2} + 7\,{}^{d\,y(t)}/_{d(t)} + 12y(t) = 2x(t)$$ If the input x(t) to the LTI system is given by **$x(t) =2e^{-2t} u(t)$** determine the response y(t). (7)			
14 (a)	i) Compute the Fourier transform of $x[n] = a^{\|n\|}$, **|a| <1.** (6)	13	4	3
	ii) For an LTI system whose input and output are related by the difference-equation, $y[n] - {}^{3}/_{4}\,y[n-1] + {}^{1}/_{8}\,y[n-2] = 2x[n]$, determine $H(e^{jw})$. (7)			

	OR			
14 (b)	i) Find $X(z)$ for $x[n] = 7(1/3)^n u[n] - 6(1/2)^n u[n]$ and sketch the ROC. (6)	13	4	3
	ii) Find the inverse Z transform of $X(z) = (3 - 5/6\,Z^{-1})/(1 - 1/4\,Z^{-1})(1 - 1/3\,Z^{-1}), \lvert Z\rvert > 1/3$. (7)			
15 (a)	i) Compute and plot the convolution y[n] =x[n]*h[n] for $x[n] = \left(\frac{1}{3}\right)^{-n} u[-n-1]$ and $h[n] = u[n-1]$. (8)	13	5	4
	ii) Draw the direct form II of a DT- LTI system whose transfer function is given by $H(z) = (1 - 5/6\,Z^{-1})/(1 - 1/4\,Z^{-1})(1 - 3Z^{-1})$. (5)			
	OR			
15 (b)	i) Consider a causal DT-LTI system whose input and output are through the block diagram shown in Fig.3.  **Fig.3** a) Determine a difference equation relating x[n] and y[n]. (5) b) Is this system stable? (8)	13	5	4

PART- C (1x 15=15Marks)
(Q.No.16 is compulsory)

Q. No.	Questions	Marks	CO	BL
16.	i) Consider a continuous-time LTI system for which the input x(t) and output y(t) are related by the differential equation $d^2y(t)/dt^2 - dy(t)/d(t) - 2y(t) = x(t)$. a) Determine $H(s)$ (2) b) Determine h(t) for each of the following cases: A) The system is stable B) The system is causal C) The system is neither stable nor causal. (6) ii) Realize the above system using direct form for the causal case. (7)	15	3	5