INSTITUTE OF AERONAUTICAL ENGINEERING

(Autonomous)

Dundigal, Hyderabad - 500 043

ELECTRONICS AND COMMUNICATION ENGINEERING

DEFINITIONS AND TERMINOLOGY QUESTION BANK

Course Name	:	Signals and systems
Course Code	:	AECB14
Program	:	B.Tech
Semester	:	IV
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Section	:	A,B,C,D
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Chief Coordinator	:	Dr. V Padmanabha Reddy, Professor, ECE

OBJECTIVES:

I	Classify signals and systems and their analysis in time and frequency domains.
II	Study the concept of distortion less transmission through LTI systems, convolution and correlation properties.
III	Understand Laplace and Z-Transforms their properties for analysis of signals and systems.
IV	Identify the need for sampling of CT signals, types and merits and demerits of each type.

DEFINITIONS AND TERMINOLOGY QUESTION BANK

SNo	QUESTION	ANSWER	Blooms Level	CO	CLO	CLO Code
	MODULE -I Signal Analysis					
1	Define Signal.	Signal is a physical quantity that varies with respect to time, space or any other independent variable	Remember	CO 1	CLO 3	AECB14.03
2	Define system.	A set of components that are connected together to perform the particular task.	Remember	CO 1	CLO 4	AECB14.04
3	What are the major classifications of the signal?	1.Discrete time signal 2.Continuous time signal	Remember	CO 1	CLO 3	AECB14.03
4	Define discrete time signals	Discrete time signals are defined only at discrete times, and for these signals, the independent variable takes on only a discrete set of values.	Remember	CO 1	CLO 3	AECB14.03
5	Define continuous time signals	Continuous time signals are defined for a continuous of values of the independent variable. In the case of continuous time signals the independent variable is continuous.	Remember	CO 1	CLO 3	AECB14.03
6	Define discrete time unit step	Discrete time unit step signal is defined by U[n]={0,n≤0 1,n≥ 0	Remember	CO 1	CLO 3	AECB14.03
7	Define discrete time unit	Discrete time Unit impulse is defined as δ [n]= {1, n=0	Remember	CO 1	CLO 3	AECB14.03

	impulse.					
8	Define unit ramp signal.	A ramp signal starts at t=0 and increases linearly with time't'.	Understand	CO 1	CLO 3	AECB14.03
9	Define periodic signal	A signal is said to be periodic, if it exhibits periodicity.i.e., X(t +T)=x(t), for all values of t. Periodic signal has the property that it is unchanged by a time shift of T.	Understand	CO 1	CLO 3	AECB14.03
10	Define aperiodic signal	A signal is said to be aperiodic, it is not satisfy this condition i.e., X(t +T)=x(t),	Understand	CO 1	CLO 3	AECB14.03
11	Define continuous time unit step	Continuous time Unit step signal is defined as U(t)={0, t<0 1, t ≥0	Remember	CO 1	CLO 3	AECB14.03
12	Define continuous time unit impulse.	Continuous time unit impulse is defined as δ (t)={1, t=0 0, t≠ 0	Remember	CO 1	CLO 3	AECB14.03
13	Define even signal?	A discrete time signal is said to be even when, x[-n]=x[n].The continuous time signal is said to be even when, x(-t)= x(t)	Remember	CO 1	CLO 3	AECB14.03
14	Define odd signal?	The discrete time signal is said to be odd when x[- n]= -x[n]. The continuous time signal is said to be odd when x(-t)= -x(t) Odd signals are also known as non symmetrical signal	Understand	CO 1	CLO 3	AECB14.03
15	Define Energy signal.	A signal is said to be energy signal if it have finite energy and zero power.	Remember	CO 1	CLO 3	AECB14.02
16	Define power signal	A signal is said to be power signal if it have infinite energy and finite power.	Remember	CO 1	CLO 3	AECB14.01
17	Define unit pulse function.	Unit pulse function (t) is obtained from unit step signals u(t)=u(t+1/2)- u(t-1/2)	Remember	CO 1	CLO 3	AECB14.03
18	Define continuous time complex exponential signal.	The continuous time complex exponential signal is of the form $x(t)=Ce^{at}$ where c and a are complex numbers.	Understand	CO 1	CLO 3	AECB14.03
19	What is continuous time real exponential signal?	Continuous time real exponential signal is defined by $x(t)=Ce^{at}$ Where c and a are complex numbers. If c and a are real, then it is called as real exponential.	Remember	CO 1	CLO 3	AECB14.03
20	What is continuous time growing exponential signal?	Continuous time growing exponential signal is defined as $x(t)=Ce^{at}$,Where c and a are complex numbers. If a is positive, as t increases, then x (t) is a growing exponential.	Understand	CO 1	CLO 3	AECB14.03
21	What is the energy signal formula?	$E_\infty = \int_{-\infty}^{\infty} \lvert x(t)\rvert^2 \, dt$	Remember	CO 1	CLO 3	AECB14.03
22	What is the formula of power signal?	$P_\infty = \lim_{T\to\infty} \frac{1}{2T} \int_{-T}^{T} \lvert x(t)\rvert^2 \, dt$	Remember	CO 1	CLO 3	AECB14.03
23	What is unstable system?	For a bounded input, if the output is unbounded in the system then it is said to be unstable.	Remember	CO 1	CLO4	AECB14.04
24	What is stable system?	The system is said to be stable only when the output is bounded for bounded input.	Remember	CO 1	CLO4	AECB14.04
25	Define linearity?	A system is said to be linear when it satisfies superposition and homogenate principles. Consider two systems with inputs as $x_1(t)$, $x_2(t)$, and outputs as $y_1(t)$, $y_2(t)$ respectively.	Remember	CO 1	CLO1	AECB14.01
26	Define static system?	Static system is memory-less	Remember	CO 1	CLO4	AECB14.04

27	Define dynamic system	Dynamic system is a memory system.	Remember	CO 1	CLO4	AECB14.04
28	What is mean square error?	The average **squared** difference between the estimated values and the actual value.	Remember	CO 1	CLO1	AECB14.01
29	Define time variant system?	A system is said to be time variant if its input and output characteristics vary with time. The condition for time variant system is: y (n , t) ≠≠ y(n-t)	Remember	CO 1	CLO4	AECB14.01
30	Define time invariant system?	A system is said to be time variant if its input and output characteristics vary with time. Otherwise, the system is considered as time invariant. The condition for time invariant system is: y (n , t) = y(n-t)	Remember	CO 1	CLO4	AECB14.01
31	What is rectangular pulse function?	It is defined as Π (t) = 1 for |t| ≤ ½. 0 otherwise.	Remember	CO 1	CLO3	AECB14.01
32	What is signum function?	Sgn(t) = 1 t > 0 -1 t<0 Sgn (t) = -1+2u (t).	Remember	CO 1	CLO3	AECB14.01
33	What is sinc function?	It is defined by the expression Sinc(t)=$sint/t$	Remember	CO 1	CLO3	AECB14.01
34	What is triangular pulse function?	It is defined as $\Lambda(t) = \begin{cases} 1-\lvert t \rvert, & \lvert t \rvert \leq 1 \\ 0, & \text{otherwise} \end{cases}$	Remember	CO 1	CLO3	AECB14.01
35	Define vector.	A vector is a quantity or phenomenon that has two independent properties: magnitude and direction. The term also denotes the mathematical or geometrical representation of such a quantity	Remember	CO 1	CLO2	AECB14.01
36	What are orthogonal bases?	In orthogonal basis, every vector is perpendicular to every other vector. The co-ordinate axes re mutually orthogonal.	Remember	CO 1	CLO2	AECB14.01

MODULE – II

Fourier Serisand Fourier Transforms.

1	Define Fourier Series?	A Periodic Signal x(t) with fundamental period T.If there exists a convergent series. $x(t) = \sum_{n=-\infty}^{\infty} c_n e^{j\omega t}$ · w=$\frac{2\pi}{T}$ The series is called Fourier Series.	Understand	CO 2	CLO 5	AECB14.05
2	What is Dirichelt Condition?	1. The function x(t) have only a finite number of maxima and minima. 2. The function x(t) posses a finite number of discontinuities. 3. x (t) is absolutely integrable over one periodic. i.e.,$\int_0^T \lvert x(t) \rvert dt < \infty$.	Remember	CO 2	CLO 5	AECB14.05
3	What is the half-wave symmetry?	A periodic signal satisfying the condition X(t)=$x(t \pm t/T)$	Understand	CO 2	CLO 5	AECB14.05

		is said to have half-wave symmetry.				
4	What is Parseval's theorem?	Two periodic signals and $x_2(t)$ with the equal period T.If the Fourier series coefficients of these two signals are $c_n$and $d_n$are then $\frac{1}{T}\int_0^T |x1(t)|.2 = \sum_{n=-\infty}^{\infty} |C_n|2$	Remember	CO 2	CLO 5	AECB14.05
5	Define Shifting Property of Continuous time Fourier series?	If the Fourier coefficients of x(t) are c_n,then the Fourier Coefficients of The Signal $x(t-t_0)$ are $FS[x(t-t_0)] = e^{-j(2\Pi/T)\Omega_0} C_n$.	Understand	CO2	CLO 5	AECB14.05
6	What is the Trigonometric Fourier Series?	The Trigonometric Representation of Fourier series x(t) is $a0 + \sum_{n=1}^{\infty} ancos(n\omega t) + \sum_{n=1}^{\infty} bnsin(n\omega t)$	Remember	CO2	CLO 5	AECB14.05
7	What is Cosine Representation of the Fourier Series?	The cosine Representation of Fourier series x(t) is $=\sum_{n=0}^{\infty} ACOS(n\omega t) + \theta n)$	Remember	CO 2	CLO 5	AECB14.05
8	What is Exponential Fourier Series?	$Cn = {}^{1}/_{T}\int_0^T x(t)e^{-jnwt}\, dt$	Remember	CO 2	CLO 5	AECB14.05
9	Define Convolution Property?	$FS[x_1(t) * x_2(t)] = TC_nd_n$.	Remember	CO 2	CLO 5	AECB14.05
10	What is the Time shifting Property?	If the Fourier series coefficients of x(t) are C_n, then the Fourier Series coefficients of the shifted signal $x(t-t_0)$ are $FS[x(t-t_0)] = e^{-jn\omega 0t} C_n$.	Remember	CO2	CLO 5	AECB14.05
11	Define Fourier Transform?	x(t) be a signal $-\infty < t < \infty$ and x(t) is absolutely integrable, then the Fourier transform of x(t) is $X(J\omega)=\int_{-\infty}^{\infty} x(t)e^{-jwt}\, dt.$	Understand	CO 2	CLO 7	AECB14.07
12	Define Inverse Fourier Transform?	It is defined as $X(t)= \frac{1}{2\pi}\int_{-\infty}^{\infty} X(j\omega)e^{j\omega t}\, d\omega.$	Remember	CO 2	CLO 7	AECB14.07
13	What is the Condition for existence of F.T of a signal x (t)?	$\int_{-\infty}^{\infty\|} x(t)\|dt. < \infty$	Understand	CO 2	CLO 7	AECB14.07
14	What is the Duality Property Of F.T	$F[x(t)] = X(j\omega)$ then $F[x(t)]= 2\Pi x(-j\omega)$	Remember	CO 2	CLO 7	AECB14.07
15	Define Convolution Property of F.T	If x(t) and h(t) are having Fourier transform $X(j\omega)$ and $H(j\omega)$ then $F[x(t)*h(t)] = X(j\omega)\, H(j\omega)$.	Remember	CO 2	CLO 7	AECB14.07
16	What is Frequency shifting property	$F[x(t)] = X(j\omega)$ then $F[x(t)\, e^{j\omega 0t}] = X(j(\omega-\omega_0)]$.	Remember	CO 2	CLO 7	AECB14.07

	of F.T					
17	What is Parseval's theorem for continuous time periodic signal?	$X_1(t)$ and $x_2(t)$ be signals with Fourier Transform $X_1(j\omega)$ and $X_2(j\omega)$ Then we have, $\int_{-\infty}^{\infty} x1(t)x2*(t) = \frac{1}{2\pi}\int_{-\infty}^{\infty} X1(j\omega)X2*(j\omega)\,d\omega.$	Remember	CO 2	CLO 7	AECB14.07
	What is the property of Time reversal F.T	F[x(t)] = X(jω) then F[-x(t)] = X(-jω)	Remember	CO 2	CLO 7	AECB14.07
	Define Linear property of F.T	If F[x_1(t)] = X_1(jω) and F[x_1(t)] = X_1(jω) Then F[a_1x_1(t) + ax_2(t)] = a_1X_1(jω) + a_2 X_2(jω)	Remember	CO 2	CLO 7	AECB14.07
	What is Differentiation Property?	If F[x(t)] = X(jω) then $\frac{dx(t)}{dt} \xleftrightarrow{\text{F.T}} j\omega.X(\omega)$	Remember	CO 2	CLO 7	AECB14.07
	What is the impulse function of Fourier transform?	$\mathcal{F}[\delta(t)] = \int_{-\infty}^{\infty} \delta(t)e^{-j2\pi ft}dt = 1$	Remember	CO 2	CLO 7	AECB14.07
	What is the FT of Unit Step Function:	U(ω)=πδ(ω)+1/jω	Remember	CO 2	CLO 7	AECB14.07
	Define Gibbs Phenomena.	The Gibbs phenomenon is the step response of a low-pass filter, and the oscillations are called ringing or ringing artifacts. Truncating the Fourier transform of a signal on the real line, or the Fourier series of a periodic signal (equivalently, a signal on the circle) corresponds to filtering out the higher frequencies by an ideal low-pass/high-cut filter.	Understand	CO 2	CLO 7	AECB14.07
	What FT of Signum Function?	Fourier transform of signum function is $2/jw$	Remember	CO 2	CLO 7	AECB14.07
	What is the F.T of exponential	$e^{-a\lvert t\rvert} \xleftrightarrow{\text{F.T}} \frac{2a}{a^2+\omega^2}$	Remember	CO 2	CLO 7	AECB14.07
	What is the convergence condition?	The infinite series in equation 1 may be converges or may not. x(n) is absolutely summable when $\sum_{n=-\infty}^{\infty} \lvert x(n)\rvert < \infty$	Remember	CO 2	CLO 7	AECB14.07

	Define Hilbert transform.	Hilbert transform of a signal x(t) is defined as the transform in which phase angle of all components of the signal is shifted by ±90. $\hat{x}(t) = \frac{1}{\pi}\int_{-\infty}^{\infty}\frac{x(k)}{t-k}dk$	Remember	CO 2	CLO 8	AECB14.08
	Define discrete Fourier transform	The discrete-time Fourier transform (DTFT) or the Fourier transform of a discrete–time sequence x[n] is a representation of the sequence in terms of the complex exponent tial sequence $e^{jwn.}$	Understand	CO 2	CL0 6	AECB14.06
	Define Convergence Condition	I or may not. x $X(\omega) = \Sigma_{n=-\infty}^{\infty} x(n)e^{-j\omega n}$ when $\sum_{n=-\infty}^{\infty} \lvert x(n)\rvert < \infty$	Understand	CO 2	CL0 6	AECB14.06
	What is formula of $\cos 2\pi f_0 t$ in F.T	$\mathcal{F}\{\cos(2\pi f_0 t)\} = \frac{1}{2}(\delta(f-f_0)+\delta(f+f_0))$	Remember	CO 2	CL0 7	AECB14.07
	What is formula of $\sin\omega_0 t$ in F.T?	$_0)]$	Remember	CO 2	CL0 7	AECB14.07
	What is the F.T of rectangular pulse?	Fourier transform of rectangular pulse is SINC function.	Remember	CO 2	CL0 7	AECB14.07
	What is the integration property in F.T?	$\int x(t)\,dt \xleftrightarrow{F.T} \frac{1}{j\omega}X(\omega)$	Remember	CO 2	CL0 7	AECB14.07
	What is F.T of unit step function?	$/j\omega$	Remember	CO 2	CL0 7	AECB14.07
	What is the formula of $Ae^{-at}u(t)$?	$X(j\omega) = A/(a+\omega)$	Remember	CO 2	CL0 7	AECB14.07
	What is the formula of $Ae^{-a\lvert t\rvert}u(t)$?	$X(j\omega) = 2aA/(a^2+\omega^2)$	Remember	CO 2	CL0 7	AECB14.07
	What is the inverse F.T of $\delta(\omega)$?	The inverse fourier transform is $F^{-1}[\delta(\omega)] = 1/2\pi$.	Understand	CO 2	CL0 7	AECB14.01
	What is the inverse F.T of $\delta(\omega-\omega_0)$?	The inverse fourier transform is $F^{-1}[2\pi\delta(\omega)] = 1$.	Understand	CO 2	CL0 7	AECB14.01
MODULE – III SIGNAL TRANSMISSION THROUGH LINEAR SYSTEMS.						
1	What is Distortion less Transmission?	A Transmission is said o be distortion less if the output is same as input, except the magnitude is scaled by a constant K and the waveform is delayed by t_d sec.	Understand	CO 3	CLO 9	AECB14.09
2	What are the different types of distortions in linear system?	1. Amplitude Distortion. 2. Phase distortion.	Understand	CO 3	CLO 10	AECB14.10
3	Define amplitude	In amplitude distortion the amplitudes of	Remember	CO 3	CLO	AECB14.10

	distortion?	various frequency components undergo different amplification.			10	
4	Define Phase Distortion?	In phase distortion the relative phases of various frequency components may be disturbed.	Remember	CO 3	CLO 10	AECB14.10
5	What is the output of a distortion les system?	If x(t) is the input signal, then the output y(t) of a distortion less system is $Y(t) = Kx(t-t_d)$	Understand	CO 3	CLO 10	AECB14.10
6	Define Signal Bandwidth?	The band of frequencies the contains most of the signal energy is known as bandwidth of the signal.	Remember	CO 3	CLO 10	AECB14.10
7	Define System Bandwidth?	The range of frequencies for which the magnitude | H (j$\boldsymbol{\omega}$) | of the system remains with $\frac{1}{\sqrt{2}}$ of its maximum value is known as system bandwidth.	Remember	CO 3	CLO 10	AECB14.10
8	Define Rise time?	The rise time t_r is the time required for the response to rise from 10 to 90% of the final value.	Remember	CO 3	CLO 10	AECB14.10
9	What is the relationship between bandwidth and rise time?	The rise time is inversely proportional to the bandwidth.	Understand	CO 3	CLO 10	AECB14.10
10	What is paley-weiner Criterion?	The **Paley-Wiener criterion** is the frequency equivalent of the causality condition in the time domain. It states that the magnitude of the transfer function can be exactly zero only a discrete frequencies but not over a finite band of frequencies.	Understand	CO 3	CLO 11	AECB14.11
11	What is physically realizable impulse response?	A system is said to be physically realizable if impulse response h(t)=0 for t<0.	Understand	CO 3	CLO 10	AECB14.10
12	What is the condition on impulse response for a linear phase	The impulse response is symmetrically about $t=t_d$.	Understand	CO 3	CLO 10	AECB14.10
13	Define Continuous systems	The type of systems whose input and output both are continuous signals or analog signals are called continuous systems.	Remember	CO 3	CLO 10	AECB14.10
14	Define Discrete systems	The type of systems whose input and output both are discrete signals or digital signals are called digital systems.	Remember	CO 3	CLO 10	AECB14.10
15	Define Casual System	A system is causal if the output depends only on present and past, but not future input.	Remember	CO 3	CLO 10	AECB14.10
16	Define LTI system	A system is said to be LTI if it satisfies both liniarity and time invariance properties.	Remember	CO 3	CLO 9	AECB14.09
17	Define transfer function of LTI system.	The ratio of laplace transform of output y(t) to the laplace transform of intput is called transfer function.	Remember	CO 3	CLO 9	AECB14.09
18	Define impulse response	If the input to the system is impulse input then its response is called impulse response.	Remember	CO 3	CLO 9	AECB14.09
19	What is magnitude spectrum for distortionless system.	For a distortionless transmission, the magnitude spectrum has to be constant over the entire frequency band.	Understand	CO 3	CLO 9	AECB14.09
20	Define LTV system	A system is said to be LTV if it satisfies both liniarity and time variance properties.	Remember	CO 3	CLO 9	AECB14.09
21	Define cutoff	The cutoff frequency is defined as the	Remember	CO 3	CLO 9	AECB14.09

	frequency	frequency at which the ratio of the (input/output) has a magnitude of 0.707				
22	Define low pass filter	A low-pass filter is a filter that passes signals with a frequency lower than a selected cutoff frequency and attenuates signals with frequencies higher than the cutoff frequency.	Remember	CO 3	CLO 9	AECB14.09
23	Define high pass filter	A high-pass filter is a filter that passes signals with a frequency higher than a selected cutoff frequency and attenuates signals with frequencies lower than the cutoff frequency.	Remember	CO 3	CLO 9	AECB14.09
24	Define band-pass filter	A band-pass filter or bandpass filter is a device that passes frequencies within a certain range and rejects frequencies outside that range.	Remember	CO 3	CLO 9	AECB14.09
25	Define band-stop filter	A band-stpo filter or bandreject filter is a device that rejects frequencies within a certain range and passes frequencies outside that range.	Remember	CO 3	CLO 9	AECB14.09
26	Define All-Pass System	All-Pass System has a constant amplitude response, but doesn't always have a linear phase response.	Remember	CO 3	CLO 9	AECB14.09
27	Define ideal filter	A filter has a unit gain (0 dB) in the passband and a gain of zero (-∞ dB) in the stopband is called idelfilter..	Remember	CO 3	CLO 9	AECB14.09
28	Define practical filter	A filter has a finite transition band always exists between the passband and the stopband is called practical filter. In the transition band, the gain of the filter changes gradually from one (0 dB) in the passband to zero (-∞ dB) in the stopband.	Remember	CO 3	CLO 9	AECB14.09
29	Define Convolution	Convolution is a mathematical way of combining two signals to form a third signal.	Remember	CO 3	CLO 12	AECB14.12
30	Define De Convolution	Deconvolution is reverse process to convolution widely used in signal and image processing.	Remember	CO 3	CLO 12	AECB14.12
31	Define Commutative Propertyof Convolution.	Commutative Property of convolution states that $x_1(t)*x_2(t)=x_2(t)*x_1(t)$	Remember	CO 3	CLO 12	AECB14.12
32	DefineDistributive Propertyof Convolution.	Distributive Property of convolution states that $x_1(t)*[x_2(t)+x_3(t)]=[x_1(t)*x_2(t)]+[x_1(t)*x_3(t)$	Remember	CO 3	CLO 12	AECB14.12
33	DefineAssociative Property of Convolution.	Associative Property of convolution states that $x_1(t)*[x_2(t)*x_3(t)]=[x_1(t)*x_2(t)]*x_3(t)$	Remember	CO 3	CLO 12	AECB14.12
34	DefineShifting Propertyof Convolution	Shifting Propertyof Convolutionstates that $x_1(t-t0)*x_2(t-t1)=y(t-t0-t1)$	Remember	CO 3	CLO 12	AECB14.12
35	Define Convolution with Impulse	Convolution with Impulse is the signal itself. $x(t)*\delta(t)=x(t)$	Remember	CO 3	CLO 12	AECB14.12
36	Define Convolution of Unit Step	Convolution of Unit Step function is ramp function. $u(t)*u(t)=r(t)$	Remember	CO 3	CLO 12	AECB14.12
37	Define Scaling Property of convolution	Scaling Propertyof Convolutionstates that If $x(t)*h(t)=y(t)$x(t)*h(t)=y(t) then $x(at)*h(at)=1\|a\|y(at)$	Remember	CO 3	CLO 12	AECB14.12

38	DefineDifferentiation of Output of LTI system	Differentiation of Output of LTI system states that if $y(t)=x(t)*h(t)$ then $dy(t)/dt=dx(t)/dt*h(t)$ or $dy(t)/dt=x(t)*dh(t)/dt$	Remember	CO 3	CLO 9	AECB14.09
39	What is Convolution of two causal sequences?	Convolution of two causal sequences is also causal.	Understand	CO 3	CLO 12	AECB14.12
40	What is Convolution of two anti causal sequences?	Convolution of two anti causal sequences is also anti causal.	Understand	CO 3	CLO 12	AECB14.12
41	What is Convolution of twounequal length rectangles?	Convolution of two unequal length rectangles results a trapezium.	Understand	CO 3	CLO 12	AECB14.12
42	What is Convolution of twoequal length rectangles?	Convolution of two equal length rectangles results a triangle	Understand	CO 3	CLO 12	AECB14.12
43	What is Convolution of a signal with itself?	A function convoluted itself is equal to integration of that function.	Understand	CO 3	CLO 12	AECB14.12
44	What are Limits of Convoluted Signal?	If two signals are convoluted then the resulting convoluted signal has following range is Sum of lower limits < t < sum of upper limits .	Understand	CO 3	CLO 12	AECB14.12
45	What is Area of Convoluted Signal?	The area under convoluted signal is equal to the product of area under impulse response and area under output signal.	Understand	CO 3	CLO 12	AECB14.12
46	Define DC component of any signal.	DC component of any signal is the ratio of area of the signal to the period of the signal.	Understand	CO 3	CLO 9	AECB14.09
47	What is length of Discrete Convolution	if any two sequences have m, n number of samples respectively, then the resulting discrete convoluted sequence will have [m+n-1] samples.	Understand	CO 3	CLO 12	AECB14.12
48	What is length of periodic or circular convolution	If two sequences of length m, n respectively are convoluted using circular convolution then resulting sequence having max [m,n] samples.	Understand	CO 3	CLO 12	AECB14.12
49	Define invertiblesystem	A system is said to be invertible if distinct inputs lead to distinct outputs	Understand	CO 3	CLO 9	AECB14.09
50	Define step response	If the input to the system is step input ,then the its response is called step response.	Understand	CO 3	CLO 9	AECB14.09
MODULE – IV LAPLACE AND Z-TRANSFORM						
1	Define Laplace transform?	A signal x(t) is defined as $X(S) = \int_{-\infty}^{\infty} x(t)e^{-st}\,dt.$ Where S=σ+jω	Understand	CO 4	CLO 13	AECB14.13
2	What is Region of convergence (ROC)	The ROC of X(S) is the set of all values of σ for which the Laplace transform convergence.	Remember	CO 4	CLO 14	AECB14.14

3	Define transfer function.	The transfer function of the system is the ratio of the Laplace transform of the output signal to the Laplace transform of the input signal with all initial conditions are zero.	Understand	CO 4	CLO 15	AECB14.15
4	Define natural response	The natural response of the system is the part of the total response which is due to initial conditions of the system alone.	Understand	CO 4	CLO 15	AECB14.15
5	Define forced response	The forced response of the system is the part of the total response which is due to input alone.	Understand	CO 4	CLO 13	AECB14.13
6	Define poles and zeros of a transfer function.	The transfer function of a system is the ratio of two polynomials. The roots of the numerator polynomial are called the zeros of the transfer function. The roots of the denominator polynomial are called poles of the transfer function.	Understand	CO 4	CLO 14	AECB14.14
7	Define transient response	The part of forced response which is due to to poles of the system is known as transient response.	Understand	CO 4	CLO 13	AECB14.13
8	Define steady state response.	The part of forced response which is due to to poles of the input signal X(S) is known as transient response.	Understand	CO 4	CLO 13	AECB14.13
9	What is the initial value theorem of L.T	The initial value theorem allows calculate x(0) directly from the transform X(s) $\lim_{t\to 0} x(t) = \lim_{s\to\infty} sX(S)$	Remember	CO 4	CLO 14	AECB14.14
10	What is the final value theorem of Laplace transform	$\lim_{t\to\infty} x(t) = \lim_{s\to 0} sX(S)$	Remember	CO 4	CLO 14	AECB14.14
11	What is the L.T of the $\cos\Omega_0 t$	$L[\cos\Omega_0 t] = \frac{S}{S^{2+}\Omega 0^2}$	Remember	CO 4	CLO 14	AECB14.14
12	What is the L.T of the $\sin\Omega_0 t$	$L[\sin\Omega_0 t] = \frac{\Omega 0}{S^{2+}\Omega 0^2}$	Remember	CO 4	CLO 14	AECB14.14
13	What is the condition for convergence of L.T	The necessary condition for convergence of the L.T is absolutely integrable. $\int_{-\infty}^{\infty} \lvert x(t)e^{-\sigma t}\rvert < \infty$	Remember	CO 4	CLO 14	AECB14.14
14	Define Z-transform.	The z-transform of a discrete time sequence x(n),is defined as $X(z) = \sum_{n=-\infty}^{\infty} x(n)z^{-n}$	Understand	CO 4	CLO 15	AECB14.15
15	Define infinite Z-transform.	The inverse z-transform of X(z) is defined as $x(n) = \frac{1}{2\pi j}\oint X(z)z^{n-1}$	Understand	CO 4	CLO 15	AECB14.15
16	What is the z-transform of impulse function?	For an impulse sequence x(n) = δ(n); the z-transform X(z)=1.	Remember	CO 4	CLO 15	AECB14.15
17	What is the initial value theorem in z-transform?	If x(n) is causal, then $x(0) = \lim_{z\to 1} X(z)$	Remember	CO 4	CLO 16	AECB14.16
18	What is the final value theorem in z-transform	If x(n) is causal, then z{x(n)} $x(\infty) = \lim_{z\to 1}(z-1)X(z)$	Remember	CO 4	CLO 16	AECB14.16
19	What is the ROC of a finite duration causal sequence?	The ROC of a finite duration causal sequence is entire z-plane except at z=0.	Remember	CO 4	CLO 16	AECB14.16
20	What is the ROC	The ROC of a finite duration anti causal	Remember	CO 4	CLO 16	AECB14.16

	of a finite duration ant causal sequence?	sequence is entire z-plane except at z=∞.				
21	What is the condition for convergence of L.T?	It is absolutely integrable of $x(t)e^{-\sigma t}$.Thatis,X(s) exists if $\int_{-\infty}^{\infty} \lvert x(t)\rvert e^{-\sigma t} \rvert < \infty$	Remember	CO 4	CLO 16	AECB14.16
22	What is the Laplace transform of unit step function?	$L[u(t)] = \frac{1}{S}$	Remember	CO 4	CLO 13	AECB14.13
23	What is the L.T of $COS\omega_0 tu$ (t).	$L[COS\omega_0 t\ u(t)] = S / S^2 + \omega_0^{2.}$	Remember	CO 4	CLO 13	AECB14.13
24	What is the L.T of $Sin\omega_0 tu$ (t).	$L[sin\omega_0 t\ u(t)] = \omega_0 / S^2 + \omega_0^2$	Remember	CO 4	CLO 13	AECB14.13
25	What is the condition for stability of a system?	For a system to be stable, the pole of the transfer function must be in the left half of s-plane.	Remember	CO 4	CLO 13	AECB14.13
26	What are the transfer functions?	1. An ideal integrator. 2. An ideal delay of T seconds. 3.The transfer function of ideal integrator is 1/s.	Remember	CO 4	CLO 13	AECB14.13
27	What are the different types of realization?	1. Direct form I realization. 2. Direct form II realization. 3. Cascode form realization. 4. Parallel-form realization.	Remember	CO 4	CLO 13	AECB14.13
28	Define state of a system.	It is a minimal set of variables known as state variables, it provides the state and output for the system is $t>t_0$.	Understand	CO 4	CLO 13	AECB14.13
29	Define signal flow graph.	A signal flow graph is a graphical representation of the relationships between the variables of a set of linear algebraic equations.	Understand	CO 4	CLO 13	AECB14.13
30	Define block diagram.	It is a interconnection of subsystem representing certain basic mathematical operation in such a way that the overall diagram represents the system's mathematical model.	Understand	CO 4	CLO 13	AECB14.13
31	What are the different methods of evaluating inverse z-transform?	1. Long division method. 2. Partial fraction expansion method. 3. Residue method. 4. Convolution method.	Remember	CO 4	CLO 13	AECB14.13
32	What is the Parseval's relation in z-transform?	$\int_{-\infty}^{\infty} x_1(t)x_2(t)\,dt = \frac{1}{2\pi}\int_{-\infty}^{\infty} X_1(\omega)X_2^*(\omega)\,d\omega$ $\int_{-\infty}^{\infty} \lvert x(t)\rvert^2\,dt = \frac{1}{2\pi}\int_{-\infty}^{\infty} \lvert X(\omega)\rvert^2\,d\omega$	Remember	CO 4	CLO 16	AECB14.16
33	What are the properties of ROC?	1. The ROC cannot contain any poles. 2. The ROC must be a connected region. 3. The ROC of an LTI stable system contains the unit circle. 4. The ROC is a ring or disc in the z-plane centered at the origin.	Remember	CO 4	CLO 16	AECB14.16

34	What is the convolution property in the Z-Transform?	If $Z\{x1(n)\} = X_1(Z)$ and $Z\{x2(n)\} = X_2(Z)$ then $Z\{x_1(n)\} * x_2(n)\} = X_1(Z)\, X_2(Z)$.	Remember	CO 4	CLO 16	AECB14.16
35	What is the z-transform of unit step function?	$X(Z) = \frac{1}{1-Z^{-1}}$	Remember	CO 4	CLO 16	AECB14.16
36	Define System function.	Let x(n) and y(n) are the input and output sequences of an LTI system with impulse h(n).the system function of the LTI system is defined as the ratio of Y(Z) and X(Z).That is $H(Z)=\frac{Y(Z)}{X(Z)}$	Understand	CO 4	CLO 15	AECB14.15
37	What is the Z-Transform of the sequence $x(n)= a^n u(n)$	$X(Z) = \frac{Z}{Z-a}$ ROC: $\|z\| > \|a\|$.	Understand	CO 4	CLO 15	AECB14.15
38	What is the Z-Transform of the sequence x (n) = nu (n)?	$Z[nu(n)] = \frac{z}{(z-1)2}$	Understand	CO 4	CLO 15	AECB14.15
39	What is ROC of a finite duration of ant casual sequence?	The ROC of a finite duration ant casual sequence is entire Z-Plane except at $z = \infty$	Understand	CO 4	CLO 15	AECB14.15
40	What is the time reversal property of the z-transform?	If $Z\{x_1(n)\} = X(Z)$ and $Z\{x_2(n)\} = X_2(Z)$ then $Z\{x_1(n)\} * x_2(n)\} = X_1(z)\, X_2(Z)$.	Understand	CO 4	CLO 15	AECB14.15
MODULE – V SAMPLING THEOREM						
1	Define sampling theorem	The sampling frequency $f_s \geq 2f_m$, the sampling frequency must be at least twice the highest frequency present in the signal.	Remember	CO 5	CLO 17	AECB14.17
2	Define nyquist rate	The frequency $2f_m$,which is under sampling theorem must be exceeded by the sampling frequency is known as nyquist rate.	Remember	CO 5	CLO 17	AECB14.17
3	Define anti aliasing filter	A filter that is used to reject high frequency signals before it is sampled to reduce the aliasing is called anti aliasing filter.	Remember	CO 5	CLO 17	AECB14.17
4	What is the transfer function of a zero order hold	The transfer function of a zero order	Understand	CO 5	CLO 18	AECB14.18
5	Define sampling interval	The sampling interval has been taken as fixed and it is defined to be the unit interval.	Remember	CO 5	CLO 18	AECB14.18
6	Define band limited signal	A Band-limited signal is one whose Fourier Transform is non-zero on only a finite interval of the frequency axis.	Remember	CO 5	CLO 18	AECB14.18
7	Define impulse sampling	**Impulse sampling** can be performed by multiplying input signal x(t) with **impulse** train of period 'T'.	Remember	CO 5	CLO 18	AECB14.18
8	Define natural sampling	Natural Sampling is a practical method of sampling in which pulse have finite width equal to τ. Sampling is done in accordance with the carrier signal which is digital in nature.	Remember	CO 5	CLO 18	AECB14.18

9	Define flattop sampling	Natural Sampling is a practical method of sampling in whichthe pulse is in the form of flat top .	Remember	CO 5	CLO 18	AECB14.18
10	Define under sampling	Undersampling is a technique where one samples a bandpass-filtered signal at a sample rate below its Nyquist rate	Remember	CO 5	CLO 18	AECB14.18
11	Define over sampling	Oversampling is the process of sampling a signal at a sampling frequency significantly higher than the Nyquist rate.	Remember	CO 5	CLO 18	AECB14.18
12	Define perfect sampling	Perfect sampling is the process of sampling a signal at a sampling frequency significantly equal to the Nyquist rate.	Remember	CO 5	CLO 18	AECB14.18
13	Define band pass sampling	Bandpass sampling is a technique where one samples a band pass-filtered signal at a sample rate below its Nyquist rate	Remember	CO 5	CLO 18	AECB14.18
14	Define Correlation	Correlation describes the mutual relationship which exists between two or more things.	Remember	CO 5	CLO 19	AECB14.19
15	Define auto Correlation	Autocorrelation, also known as serial correlation, is the correlation of a signal with a delayed copy of itself.	Remember	CO 5	CLO 19	AECB14.19
16	Define cross Correlation	Cross-correlation is a measure of similarity of two series as a function of the displacement of one relative to the other.	Remember	CO 5	CLO 19	AECB14.19
17	Define symmetry property of auto Correlation	Auto correlation exhibits conjugate symmetry i.e. $R(\tau) = R^*(-\tau)$	Remember	CO 5	CLO 19	AECB14.19
18	Define auto Correlation of energy signal	Auto correlation function of energy signal at origin i.e. at $\tau=0$ is equal to total energy of that signal,	Remember	CO 5	CLO 19	AECB14.19
19	Define maximum value of auto Correlation	Auto correlation function is maximum at $\tau=0$ i.e $\|R(\tau)\| \leq R(0)\ \forall\tau$	Remember	CO 5	CLO 19	AECB14.19
20	Define relation between correlation and PSD	Correlation function and power spectral densities are Fourier transform pairs.	Remember	CO 5	CLO 20	AECB14.20
21	Define Energy Density Spectrum	**Energy spectral density** describes how the **energy** of a signal or a time series is distributed with frequency	Remember	CO 5	CLO 20	AECB14.20
22	Define Power Density Spectrum	**Power spectral density** describes how the **power** of a signal or a time series is distributed with frequency	Remember	CO 5	CLO 20	AECB14.20
23	Define Parseval's theorem	Parseval's theorem for energy signals states that the total energy in a signal can be obtained by the spectrum of the signal	Remember	CO 5	CLO 20	AECB14.20
24	Define correlation theorem	Cross correlation function corresponds to the multiplication of spectrums of one signal to the complex conjugate of spectrum of another signal.	Remember	CO 5	CLO 19	AECB14.19
25	Define aliasing	**Aliasing** is an effect that causes different signals to become overlapped (or **aliases** of one another) when sampled.	Remember	CO 5	CLO 17	AECB14.17
26	Define methods to reduce aliasing	considering $f_s>2f_m$or by using anti aliasing filters.	Remember	CO 5	CLO 17	AECB14.17
27	Give auto correlation formula	The auto correlation of x(t) is $R_{11}(\tau) = R(\tau) = \int_{-\infty}^{\infty} x(t)x(t-\tau)dt$	Understand	CO 5	CLO 19	AECB14.19

28	Give cross correlation formula	The cross correlation of $x_1(t)$ and $x_2(t)$ is $R_{12}(\tau) = \int_{-\infty}^{\infty} x_1(t)x_2(t-\tau)\,dt$	Understand	CO 5	CLO 19	AECB14.19
29	Give energy density spectrum formula	Energy density spectrum can be calculated using the formula $E = \int_{-\infty}^{\infty} \lvert x(f) \rvert^2 df$	Understand	CO 5	CLO 20	AECB14.20
30	Give power density spectrum formula	Energy density spectrum can be calculated using the formula $P = \Sigma_{n=-\infty}^{\infty} \lvert C_n \rvert^2$	Understand	CO 5	CLO 20	AECB14.20
31	Give spectrum of sampled signal	The spectrum of sampled signal is given by $Y(\omega) = \frac{1}{T_s}\Sigma_{n=-\infty}^{\infty} X(\omega - n\omega_s)$	Understand	CO 5	CLO 20	AECB14.20
32	Define transfer function	A transfer function represents the relationship between the output signal of a control system and the input signal.	Remember	CO 5	CLO 19	AECB14.19
33	Define incoherent or uncorrelated signals	The signals for which the cross correlation is zero for all values of τ are called uncorrelated.	Remember	CO 5	CLO 19	AECB14.19
34	Define cross correlation for orthogonal signals.	Cross correlation for orthogonal signals is zero.	Remember	CO 5	CLO 19	AECB14.19
35	Define relation between convolution and correlation.	The relation between convolution and correlation is that cross correlation of $x_1(t)$ and $x_2(t)$ is same as convolution between $x_1(t)$ and $x_2(-t)$.	Remember	CO 5	CLO 19	AECB14.19
36	Define normalized energy.	The normalized energy of a signal x(t) is defined as the energy dissipated by a voltage signal applied across a 1 ohm resistor .	Remember	CO 5	CLO 20	AECB14.20
37	Define area property of Energy spectral density.	The area under energy spectral density is equal to the total energy of that signal.	Remember	CO 5	CLO 20	AECB14.20
38	Define output of Energy spectral density.	The output of energy spectral density is defined as the multiplication of magnitude square of system function and Energy Spectrum Density of input signal.	Remember	CO 5	CLO 20	AECB14.20
39	Define average power.	The average power is defined as the power dissipated by a voltage x(t) applied across a 1 ohm resistor.	Remember	CO 5	CLO 20	AECB14.20
40	Define area property of power spectral density.	The area under energy spectral density is equal to the average power of that signal.	Remember	CO 5	CLO 20	AECB14.20
41	Define output of power spectral density.	The output of power spectral density is defined as the multiplication of magnitude square of system function and power Spectrum Density of input signal.	Remember	CO 5	CLO 20	AECB14.20
42	Define sampling frequency	The sampling frequency (or sample rate) is the number of samples per second.	Remember	CO 5	CLO 18	AECB14.18
43	Define ADC.	An analog-to-digital converter is a system that converts an analog signal, such as a sound picked up by a microphone or light entering a digital camera, into a digital signal.	Remember	CO 5	CLO 18	AECB14.18
44	Define DAC.	A digital-to-analog converter is a system that	Remember	CO 5	CLO 18	AECB14.18

		converts a digital signal into an analog signal.				
45	Define noise	Noise is an unwanted disturbance in an electrical signal.	Remember	CO 5	CLO 18	AECB14.18
46	Define SNR	SNR is defined as the ratio of signal power to the noise power.	Remember	CO 5	CLO 18	AECB14.18
47	Define reconstruction in sampling	Reconstruction usually means the determination of an original continuous signal from a sequence of equally spaced samples.	Remember	CO 5	CLO 18	AECB14.18
48	Define noise reduction	Noise reduction is the process of removing noise from a signal.	Remember	CO 5	CLO 18	AECB14.18
49	Define anti imaging filter	An “anti-imaging” or “anti-aliasing” filter is placed before the A-to-D converter, to prevent signal frequencies greater than half the sampling rate from being digitized, which would produce images at unwanted frequencies.	Remember	CO 5	CLO 18	AECB14.18
50	What is the use ofcorrelation.	Correlation is used to find the linear relationship between two numerically expressed variables.	Remember	CO 5	CLO 19	AECB14.19

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