Reg. No.															

Question Paper Code	13200

B.E. / B.Tech. - DEGREE EXAMINATIONS, NOV / DEC 2024

Third Semester

Electronics and Communication Engineering

(Common to Computer and Communication Engineering)

20ECPC303 - SIGNALS AND SYSTEMS

Regulation - 2020

Duration: 3 Hours | Max. Marks: 100

PART - A (MCQ) (20 × 1 = 20 Marks)

Answer ALL Questions

		Marks	K – Level	CO
1.	Which of the following is NOT a standard signal? (a) Step signal (b) Ramp signal (c) Sine wave (d) Harmonic signal	1	K1	CO1
2.	A unit impulse signal is defined as (a) A signal with a constant magnitude, area under it is unity (b) A signal that is present at at t = 0 and 0 elsewhere, area under it is unity (c) A signal that starts at time t = 0 and grows linearly (d) A periodic signal with infinite frequency	1	K1	CO1
3.	Energy signals have (a) Infinite energy (b) Finite power and infinite energy (c) Finite energy and zero power (d) Zero energy and infinite power	1	K1	CO1
4.	The fourier series for the function f(x)=sin2x is (a) sinx+sin2x (b) 1-cos2x (c) sin2x+cos2x (d) 0.5-0.5cos2x	1	K2	CO2
5.	In the Fourier series, the fundamental frequency of a periodic signal is (a) The highest frequency present (b) Inversely proportional to the period (c) Proportional to the amplitude (d) Equal to the DC component	1	K2	CO2
6.	In a Fourier series, the coefficients represents (a) The amplitude of sinusoidal components (b) The time delay (c) The impulse response of the system (d) The system's causality	1	K2	CO2
7.	Parseval's theorem states that (a) The energy of a signal in the time domain is equal to its energy in the frequency domain (b) The Fourier transform of a product of signals is the sum of their transforms (c) The inverse Fourier transform is the same as the forward transform (d) The energy of a signal is infinite	1	K1	CO3
8.	The property of duality in Fourier transforms states that (a) The time-domain and frequency-domain representations of a signal can be interchanged (b) A signal's Fourier transform is always real (c) Time and frequency scaling are the same (d) The Fourier series and Fourier transform are equivalent	1	K1	CO3
9.	The region of convergence (ROC) of the Laplace transform determines (a) The stability of the system (b) The frequency content of the signal (c) The time-domain characteristics (d) The periodicity of the signal	1	K2	CO3
10.	The output of a continuous-time LTI system is determined using (a) Fourier series (b) Laplace transform (c) Convolution integral (d) Differential equation	1	K2	CO4

11.	A continuous-time LTI system is causal if (a) The impulse response is zero for all negative time (b) The output depends on future inputs (c) The system is time-variant (d)) The output grows exponentially	*1*	*K2*	*CO4*
12.	A causal continuous-time LTI system described by a differential equation has which of the following characteristics? (a) The output depends only on the future values of the input (b) The output depends on both present and past values of the input (c) The system is necessarily unstable (d) The system is time-variant	*1*	*K2*	*CO4*
13.	What is the minimum sampling rate for a signal with a maximum frequency of 10 kHz? (a) 5 kHz (b) 20 kHz (c) 10 kHz (d) 15 kHz	*1*	*K2*	*CO5*
14.	A causal discrete-time LTI system's response at any time depends on (a) Past and present inputs only (b) Future inputs only (c) Present and future inputs (d) Only the present input	*1*	*K2*	*CO5*
15.	Which of the following is true about discrete-time Fourier series? (a) It can represent both periodic and aperiodic signals (b) It represents a signal as a sum of harmonics (c) It is applicable only to finite-duration signals (d) It is valid for continuous-time systems	*1*	*K1*	*CO5*
16.	The region of convergence (ROC) for a causal system in the Z-domain is (a) Outside the outermost pole (b) Inside the unit circle (c) The entire Z-plane (d) Between two circles	*1*	*K1*	*CO5*
17.	What is the result of convolving a signal with a unit impulse in a discrete-time LTI system? (a) The signal is delayed (b) The signal remains unchanged (c) The signal is amplified (d) The signal is reversed	*1*	*K1*	*CO6*
18.	The response of a linear system to input x[n] as the superposition of the scaled responses of the system to each of the shifted impulses is called _____. (a) impulse response (b) difference equation (c) convolution sum (d) none of the mentioned	*1*	*K1*	*CO6*
19.	The Z-transform of a discrete-time signal provides information about (a) The signal's time-domain behavior (b) The system's transfer function (c) The system's stability and frequency response (d) All of the above	*1*	*K1*	*CO6*
20.	In a recursive discrete-time system, the output at time n is related to (a) The sum of the current and previous inputs only (b) Both current and previous outputs (c) Future inputs and outputs (d) Only the current input	*1*	*K2*	*CO6*

PART - B (10 × 2 = 20 Marks)

Answer ALL Questions

21.	Determine energy of the signal $e^{-2t}u(t)$.	*2*	*K3*	*CO1*
22.	If u(t) is unit step signal, then draw x(t)= 1.5U(t+3).	*2*	*K3*	*CO1*
23.	Write the equations for trigonometric & exponential Fourier series.	*2*	*K2*	*CO2*
24.	State the Dirichlet's condition for the existence of Fourier series.	*2*	*K2*	*CO2*
25.	What is the relation between Fourier transform and Laplace transform?	*2*	*K2*	*CO3*
26.	Determine the Laplace transform of sin4tu(t).	*2*	*K2*	*CO3*
27.	State Nyquist sampling theorem.	*2*	*K2*	*CO4*

28. Find the Nyquist sampling rate for the signal x(t)= sin10t + cos 15t. *2 K3 CO4*

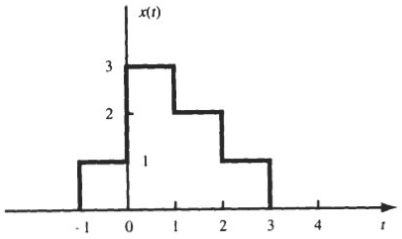
29. Find the convolution between the signals x[n]={1,2,2,1} and h[n]={1,2,3,4}. *2 K3 CO5*

30. Give the relation between impulse response and step response for a discrete time system. *2 K2 CO6*

PART - C (6 × 10 = 60 Marks)

Answer ALL Questions

31. a) *10 K3 CO1*



Transform signal x(t) as the following signals

(a) x(-t) (b) x(3t) (c) x(t+5) (d) x(-t+1) (e) 2x(-3t)

OR

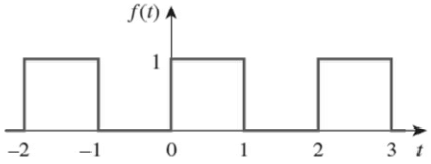
b) The following system are represented by *10 K3 CO1*

(i) y(t) = 3x(t) - 3

(ii) y(t) = t x(t+5)

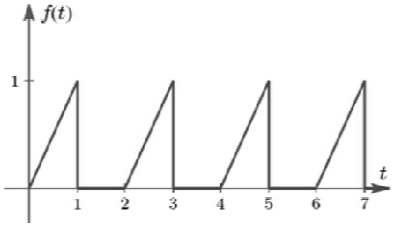
Check each of the above system for static, causal, linear, time invariant and stable. Also justify your answer.

32. a) Deduce the Amplitude - Phase form Fourier series of the given signal f(t) and obtain magnitude and phase spectra. *10 K2 CO2*



OR

b) Express the given signal f(t) in trigonometric form of Fourier series. *10 K2 CO2*



33. a) Find the inverse Laplace transform of X(s) = 4/ (s+2)(s+4) if the ROC is *10 K3 CO3*

(a) –2>Re{s}> -4

(b) Re{s} < -4

OR

b) State and prove the following properties in Fourier transform *10 K3 CO3*

(i) Convolution property

(ii) Frequency shifting

(iii) Time Shifting

(iv) Linearity

34. a) The system produces the output $y(t)= e^{-t} u(t)$ for an input $x(t) = e^{-2t} u(t)$. Find Frequency response and Impulse response using Fourier transform. *10 K3 CO4*

OR

b) Consider a continuous time LTI system for which the input x(t) and output y(t) are related by the differential equation *10 K3 CO4*

$$\frac{d^2y(t)}{dt^2} - \frac{dy(t)}{dt} - 2y(t) = x(t)$$

(i) Determine H(s). Sketch the pole zero plot.
(ii) Determine impulse response h(t) when the system is causal.

35. a) Consider the analog signal x(t) = 2cos2000πt + 5sin4000πt + 12cos2000πt. *10 K2 CO5*
(i) Obtain the Nyquist sampling rate.
(ii) If the analog signal is sampled at Fs = 5000Hz, formulate the discrete time signal obtained by sampling.

OR

b) Find the Z transform ,pole zero plot and ROC of *5 K2 CO5*
(i) $x[n] = 0.1^n u[n] + 0.2^n u[-n-1]$ *5*
(ii) $x[n] = 0.1^n u[n] + 0.2^n u[n]$

36. a) Obtain the direct form I and direct form II realization of the system *10 K3 CO6*
2y(n) = -0.5y(n-1)-0.6y(n-2) +5x(n)+3x(n-1)+2x(n-2)+5x(n-3)+7x(n-4).

OR

b) Find the transfer function and impulse response for the following system y(n)+y(n-1)-2y(n-2) = x(n-1) + 2x(n-2), given that x(n)=u(n), initial condition y(-1)=0.7; y(-2)=0.5. *10 K3 CO6*