Q. Code:868285

Reg. No. | | | | | | | | | | | | | |

B.E./B.TECH. DEGREE EXAMINATIONS, MAY 2024

Third Semester

EC22305 – SIGNALS AND SYSTEMS

(Electronics and Communication Engineering)

(Regulation 2022)

TIME: 3 HOURS **MAX. MARKS: 100**

COURSE OUTCOMES	STATEMENT	RBT LEVEL
CO 1	Categorize signals and systems based on their properties.	**3**
CO 2	Analyze the characteristics of continuous time signals using Fourier and Laplace transform.	**4**
CO 3	Characterize the Linear Time Invariant systems in time and frequency domain.	**3**
CO 4	Analyze the characteristics of discrete time signals using Fourier transform and Z transform.	**4**
CO 5	Characterize the Linear Shift Invariant systems in time and frequency domain.	**3**

PART- A (20 x 2 = 40 Marks)

(Answer all Questions)

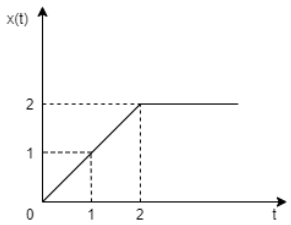
		CO	RBT LEVEL
1.	Sketch the folded version of $x[n]=u[n+3]$.	**1**	**2**
2.	Find the even and odd component of a signal $x(t)=\sin^2 t$.	**1**	**2**
3.	The input-output relationship of a system is given by $y[n]=x[n-2]$. Check the stability of the system.	**1**	**2**
4.	Find the fundamental period of the signal $x(t)=2\cos(10t+1)$.	**1**	**2**
5.	State Parseval's theorem.	**2**	**2**
6.	Given $x(t)$ and $X(s)$ are Laplace transform pair, determine the Laplace transform of $\frac{d}{dt}x(t)$ using suitable property.	**2**	**3**
7.	Let$x(t)$ and $X(j\omega)$ be Fourier transform pair, evaluate the Fourier transform of $x(-t)$.	**2**	**3**
8.	Determine the Laplace transform (including region of convergence) of a signal, $x(t)=(1-e^{-3t})u(t)$.	**2**	**3**

9.	State the condition of ROC for which the given continuous time LTI system with $H(s)=\frac{s}{s^2+s-6}$ will be stable and causal.	**3**	**2**	
10.	A causal LTI system has an impulse response, $h(t)=e^{-4t}u(t)$. Determine its frequency response.	**3**	**3**	
11.	A continuous time LTI system is characterized by a differential equation, $\frac{d^2y(t)}{dt^2}-\frac{dy(t)}{dt}+2y(t)=\frac{d}{dt}x(t)$, determine the transfer function.	**3**	**3**	
12.	Find the response of an LTI system with impulse response, $h(t)=\delta(t-3)$ and input $x(t)=u(t)$.	**3**	**3**	
13.	Find DTFT of the given sequence, $x[n]=\{1,2,2,1\}$.	**4**	**3**	
14.	Compute z transform of x$[n]=¿$ using appropriate properties.	**4**	**3**	
15.	What is the minimum sampling frequency required to sample a continuous time signal, $x(t)=\sin 2000\pi t.\cos 4000\pi t$?	**4**	**2**	
16.	Determine the initial and final value of $X(z)=\frac{2z^{-1}}{1-1.8z^{-1}+0.8z^{-2}}$.	**4**	**3**	
17.	Find the frequency response of a discrete time system described by the difference equation, $y[n]-\frac{1}{2}y[n-1]+\frac{1}{4}y[n-2]=x[n]+x[n-1]$.	**5**	**3**	
18.	An LTI system is characterized by a system function, $H(z)=\frac{z(3z-4)}{\left(z-\frac{1}{2}\right)(z-3)}$. Specify the poles and zeros of the system and hence discuss about its stability.	**5**	**2**	
19.	Find $y[n]$,if $x[n]=h[n]=\{1,1,-1\}$.	**5**	**3**	
20.	The system function of a discrete-time system is $H(z)=5z^{-1}-3z^{-2}$.Find the response of the system.	**5**	**3**	

PART- B (5 x 10 = 50 Marks)

			Marks	CO	RBT LEVEL
21. (a)	**(i)**	Identify whether the signal, $x[n]=8\cos\left(\frac{n\pi}{4}\right)$ is periodic or not. If periodic, find its fundamental period.	**(5)**	**1**	**3**
	(ii)	Find below a continuous time signal $x(t)$.Determine whether	**(5)**	**1**	**3**

the given signal is energy or power.



(OR)

(b)	Given the input - output relationship of LTI systems, specify which of the following properties hold for the given systems. (i) Linear (ii) Time - Invariant (iii) Stable (iv) Causal (v) Memoryless (a) $y(t)=(2+sint)x(t)$ (b) $y[n]=n^2 x[n-1]$	**(10)**	**1**	**3**
22. (a)	Find $x(t)$, given its Laplace transform $X(s)=\frac{s+6}{(s+1)(s¿¿2-6s+8)¿}$.	**(10)**	**2**	**3**

(OR)

(b)	Determine the Fourier transform of $x(t)=e^{-a\vee t\vee ¿¿}$, $a>0$ and hence find the Fourier transform of $x(t+3)$.	**(10)**	**2**	**3**
23. (a)	Consider a causal LTI system characterized by the differential equation, $\frac{d^2y(t)}{dt^2}$ - 9 $\frac{dy(t)}{dt}$ + 14 y(t) = 2 $x(t)$. Find the frequency response of the system and also the response of the system to an input $x(t)=e^{4t}u(t)$.	**(10)**	**3**	**3**

(OR)

(b)	Consider an LTI system characterized by the differential equation, $\frac{d^2y(t)}{dt^2}$ - 4 $\frac{dy(t)}{dt}$ - 12 $y(t)=\frac{d^2x(t)}{dt^2}$ - 8 $\frac{dx(t)}{dt}$ +15 $x(t)$. Determine the impulse response such that the system is, i. Stable ii. Causal iii. Neither stable nor causal.	**(10)**	**3**	**3**
24. (a)	Compute DTFT of the following signals using appropriate properties. (i) $x[n]=\left(\frac{1}{3}\right)^{n-3}u[n-3]$ (ii) $x[n]=u[n+1]$	**(10)**	**4**	**3**

(OR)

(b)	Determine inverse $z$transform of $X(z)=\frac{3+2z^{-1}+z^{-2}}{1-3z^{-1}+2z^{-2}}$ and also draw its ROC under causal condition.	**(10)**	**4**	**3**
25. (a)	Consider a causal LTI system characterized by a difference equation, $y[n]-\frac{3}{4}y[n-1]+\frac{1}{8}y[n-2]=2x[n]$. Find the response of the system to an input $x[n]=\left(\frac{1}{3}\right)^n u[n]$	**(10)**	**5**	**3**

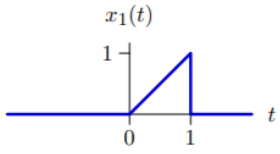
(OR)

(b)	A system function is given by $H(z)=\frac{z^2}{(z-\frac{1}{4})(z-\frac{1}{2})}$, ROC: $\lvert z\rvert>\frac{1}{4}$ Find impulse response and unit step response.	**(10)**	**5**	**3**

PART- C (1 x 10 = 10 Marks)

(Q.No.26 is compulsory)

		Marks	CO	RBT LEVEL
26.	Determine the Laplace transform and associated region of convergence for the signal $x_1(t)$ shown below.	**(10)**	**2**	**3**



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