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

Question Paper Code: U4409

B.E. / B.Tech. DEGREE EXAMINATION, APRIL 2024

Fourth Semester

Electronics and Communication Engineering

21UEC409–SIGNALS AND LINEAR SYSTEMS

(Regulations 2021)

Duration: Three hours Maximum: 100 Marks

Answer ALL Questions

PART A - (5 x 1 = 5 Marks)

1. A useful property of the unit impulse δ (t) is that CO1- U

   (a) δ (at) = a δ (t) (b) δ (at) = δ (t)

   (c) δ (at) = $\frac{1}{\delta}$ δ (t) (d) δ (at) = [δ (t)]a

2. Fourier transform of a Gaussian pulse is CO1- U

   (a) Another Gaussian pulse (b) Squared Sinc pulse

   (c) Sinc pulse (d) Impulse train

3. Given that F(s) is a one sided L.T. of f(t), the L.T. of $\int f(\tau)d\tau$is CO1- U

   (a) s F(s)-f(0) (b) 1/s F(s) (c) $\int f(\tau)d\tau$ (d) 1/s[F(s)-f(0)]

4. If the signal x(t) = cos(2000πt) is sampled at 5000 Hz such that x(n)=x(nT_s), what is the fundamental frequency of x(n) in rad/sec? CO4-App

   (a) 2π/5 (b) π (c) 2π/8 (d) π/8

5. Z[u(-n)] is CO4-App

   (a) –z/(z-1) (b) 1/z-1 (c) 1/1-z (d) z/z-1

PART – B (5 x 3= 15 Marks)

6. A given system is characterized by the differential equation; Check the system for linearity and stability CO2-App

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

7. Using the properties, Determine the Fourier transform of $x(t) = t\ e^{-at} u(t)$ CO2-App

8. Write the equation for the complete response of a CT system in terms of state transition matrix. CO1-U

9. What is aliasing? How it can be avoided? CO1-U

10. Identify all the possible regions of convergence of X(z) and sketch the plot CO4-App

$$X(z) = \frac{z(z-4)}{(z-1)(z-2)}$$

PART – C (5 x 16= 80 Marks)

11. (a) Draw the wave forms represented by following step functions CO2- App (16)
(i) $f_1(t) = 2\,u(t-1)$ (ii) $f_2(t) = -2u(t-2)$
(iii) $f(t) = f_1(t) + f_2(t)$ (iv) $f(t) = f_1(t) - f_2(t)$

Or

(b) Check all the system properties for the given CO2- App (16)

$(i)\ y(n) = x(n+1) - x(n-1)$

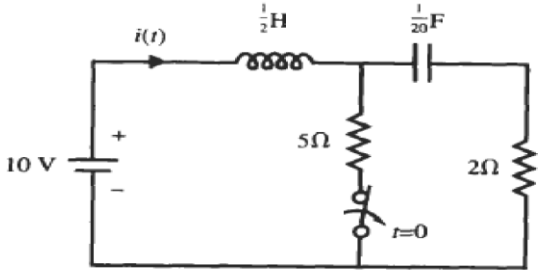
$(ii)\ \frac{dy(t)}{dt} + 5ty(t) = x(t)$

12. (a) Find the Fourier transform of a rectangular pulse of duration T with amplitude A and draw its spectrum. CO3- App (16)

Or

(b) Obtain the Fourier Transform of the signal $e^{-|t|}$ and plot its magnitude and phase spectrum. CO3- App (16)

13. (a) In the circuit shown below, the switch is in the closed position for a long time before it is opened at t=0. Find the inductor current i(t) for $t \geq 0$. CO5- Ana (16)



a) Find the impulse response of the circuit using Laplace transform.

b) Analyze the performance of the circuit by comparing their stability, causality and linearity conditions.

Or

(b) Obtain the convolution of the given two signals using the convolution property of the Laplace transform and evaluate the results also with the conventional method of convolution. CO5- Ana (16)

$x(t) = e^{-3t} u(t)$ and $y(t) = e^{-2t} u(t)$

14. (a) State and prove sampling theorem for low pass band limited signal and explain the process of reconstruction of the signal from its samples. CO1- U (16)

Or

(b) State and prove the following properties of DTFT CO1- U (16)

a) Time shifting b) Linearity c) Time scaling d) Convolution

15. (a) (i) State and prove any FIVE properties of z-transform. CO4- App (16)

(ii) Find the inverse Z-transform of $X(Z) = \frac{1}{1 - az^{-1}}$;

where the ROC $|z| < |a|$

Or

(b) Determine the z-transform and plot the ROC of the following signals. CO4- App (16)

(i) $x(n) = a^n u(n)$

(ii) $x(n) = -b^n u(-n)$