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Question Paper Code: R4409

B.E./B.Tech. DEGREE EXAMINATION, APRIL / MAY 2025

Fourth Semester

Electronics and Communication Engineering

R21UEC409– SIGNALS AND LINEAR SYSTEMS

(Regulations R2021)

Duration: Three hours

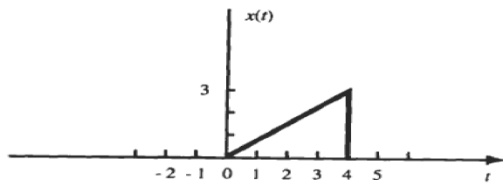
Maximum: 100 Marks

Answer ALL Questions

PART A - (10 x 2 = 20 Marks)

1. Sketch the signal $x(-t+2)$ and $-x(t-5)$

CO2-App



2. Plot the following transformations of the signals given.

CO2-App

i) $y(n) = u(n) + u(n+2)$ ii) $y(t) = u(t-2) - u(t-3)$

3. State and prove the Parseval's theorem in Fourier series.

CO1-U

4. Find harmonics and TFS coefficients of the following signals. $x(t) = 10 \cos^2(45t - 45^\circ)$

CO1-U

5. If $X(s) = \frac{2}{s-2} + \frac{1}{s-1}$, Plot the s-plane when the ROCs of the L.T is $s > 1$ and $s < 2$

CO3-App

6. Determine the inverse Laplace transform of the given $X(s) = \frac{s}{s^2 + 5s + 6}$ $\text{Re}(s) > -1$

CO3-App

7. State sampling Theorem.

CO1-U

8. Define DTFT pair. What is the relationship between DTFT and Z-Transform?

CO1-U

9. Find the Z-transform of $x(n) = n a^n u(n)$.

CO4-App

10. Find the unilateral z-transform of

CO4-App

$x(n) = \cos(\omega_0 n)$

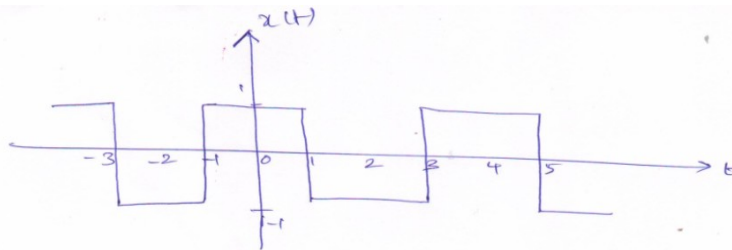
PART – B (5 x 16= 80 Marks)

11. (a) Check whether the given signals are energy or power signal. CO2-App (16)
 i) $x(t) = A \cos \omega t$, $-T < t < T$ ii) $x(n) = (1/3)^n u(n)$

Or

- (b) Check whether the following systems are static/dynamic, CO2-App (16)
 causal/non-causal, linear/non-linear, time-variant/time-invariant
 i) $y(n) = 4x(n)$ ii) $y(t) = e^{2x(t)}$ iii) $y[t] = \sin x(t)$
 iv) $y(n) = 2x(2n)$

12. (a) Obtain the trigonometric Fourier series representation of the given CO3 -App (16)
 function



Or

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

13. (a) i) Find the Laplace transform and ROC of the signal CO2-App (16)
 $x(t) = e^{at} u(t) + e^{bt} u(t)$
 ii) Find the inverse Laplace transform of
 $X(s) = 1/((s+1)(s+2))$

Or

- (b) i) Determine the initial value and final value of signal $x(t)$ whose CO2-App (16)
 Laplace Transform is, $X(S) = \frac{2s+5}{s(s+3)}$
 ii) Find the Laplace Transform of the following:
 a) $t e^{-at} u(t)$ b) $\cos(\omega_0 t) u(t)$

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

Or

- (b) State and prove the following properties of DTFT CO1 -U (16)
 a) Time shifting b) Linearity c) Time scaling d) Convolution
 e) Differentiation

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

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

ii) $x(n) = -b^n u(-n-1)$

Or

- (b) (i) Find the Z-Transform of the given signal

CO4-App (8)

$x(n) = \sin \omega n u(n)$ and hence find ROC

- (ii) Find the Z-Transform of the given signal

CO4-App (8)

$x(n) = (1/2)^n u(-n)$ and hence find ROC

